The Mysore Economic Journal

JANUARY 1920.

(Nos: 1, 4-6, 8-12 only) 400

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A Kannada edition of the JOURNAL is also published. Prospectus on application.

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The Mysore Economic Journal

A Monthly Periodical devoted to the Discussion
of all Economic Topics of Interest

PUBLISHED UNDER THE AUSPICES OF THE MYSORE ECONOMIC CONFERENCE

VOL. VI — JANUARY 1920 — No. 1

INDUSTRIAL DEVELOPMENT OF SOUTH INDIA.*

I—Agriculture.

BY DR. SLATER, M.A., D.SC.,

Professor of Indian Economics,
Madras University.

OF all industries agriculture is the most ancient and the most fundamental. We can live without Universities and without lectures; in such a climate as that of South India it is possible to live without houses and without clothes; but it is impossible to live without food. Mr. K. Sundara Rajulu, one of the contributors to the volume published by the University of Madras called "Some South Indian villages", remarks of the Nayudus that "they think, and pride themselves on the thought, that agriculture *is the noblest, the least harmful, and the most independent of all professions.*" They have good reason, Manufacturing industry is dependent on agriculture, for its function is, very largely, to work up raw materials which are themselves the product of agriculture. For these reasons it is right that the first of this short course of lectures on "Industrial Development of South India" should be devoted to the pressing problems of South Indian Agriculture.

It may, I think, be fairly claimed that of all great industries agriculture is the one that yields that greatest enjoyment in their work to the workers engaged in it. Tastes differ, and I can only speak positively for myself; but while I never, when on a holiday, desired to find my recreation by working in a coal mine or in a cotton mill, I find a fascination in agricultural work. When early this year I secured a passage home, and landed at Plymouth, and spent some time there with my mother and sisters, I took the first opportunity of digging in their allotments, and looking at the crop on a little plot I had brought into cultivation for them two years before. When I went to my own house I dug my own allotment, and rejoiced in the opportunity of getting the physical exercise which is desirable for health in that way, instead of being driven to resort, as in Madras, to the childish pursuit of knocking tennis balls over a net; and later I enjoyed the pleasure of going to Woolwich and seeing how fruit trees which I had planted years before were thriving and finding out from the present occupier what crops he had obtained from them. The pleasure of working on the land, particularly if it is your own bit of land, is twofold. There is the pleasure of the sun and air and exercise and seeing the things grow and gathering in the fruits of the soil; and there is the pleasure, by deep digging and manuring and planting trees and by other means, of increasing the fertility and beauty of the plot upon which you work. Therefore it is not

* A lecture delivered at Madras.

altogether a misfortune for a country to have an exceptionally large part of its population engaged in agriculture. In the Madras Presidency there are about five adult male workers engaged in agriculture for every two otherwise engaged. I admit it is too large a proportion, and that the economic prosperity of the country depends, in a great measure, upon the development of non-agricultural industries, and other forms of employment. There should be a reasonable proportion between agriculture and manufacture. But if a community has a choice between an ex-excess of agriculture, as in India, and an excess of manufacturing and miscellaneous employment, as in Great Britain, I think on the score of the general happiness of the mass of the people it should choose the former.

But the aspect of the matter to which I specially want to draw your attention is the fact that the very distribution of population between agriculture and other industries shows remarkable agricultural inefficiency. Five agricultural families in our presidency supply food and other agricultural produce for themselves, and for two Indian non-agricultural families, and a certain quantity of agricultural produce for export. Altogether we may say that they produce enough for eight families, or for nine at the utmost. In western Europe, North America, Australia and New Zealand, I suppose five agricultural families produce, on the average, the necessary agricultural produce for fifty families in all. Hence we cannot say that India compares favourably in agricultural efficiency with those countries. Nor does it compare favourably with China or Japan. Yet India is a country of very ancient civilization—how ancient, no one knows. Civilization may be said to begin with the era when man ceased to live by gathering wild fruits and killing wild animals, and began to subsist by growing grain and harvesting cereal crops. No one knows what land was first tilled, what grain was first sown and harvested, what beast was first made to serve the cultivator; but my own opinion is that it was Indian soil that was first tilled, even before that of Egypt or Mesopotamia, that rice was the first grain planted, even before wheat, that the buffalo and not the ox was the first animal yoked to the plough, and that some ancient form of Dravidian language was the medium these first cultivators, these pioneers of civilization, used in their conversation one with another. Other people may disagree with this opinion but they cannot prove I am wrong, and they will at least admit that Indian agriculture is extremely ancient, if not the most ancient of all.

How then can we account for the fact that the art and science of agriculture is now relatively backward in India compared with other countries of less ancient civilization? I think it is very largely because of this very antiquity of the science and art of agriculture in India. Much was learnt many generations ago, and the knowledge won embodied in proverbs and customs and traditions passed down from father to son, and the fulness of such knowledge made the pursuit of more knowledge by organized research and experiment appear both very difficult and very unnecessary. One can quite imagine that to many villagers it must have seemed presumption, if not impiety, for a young ryot to want to know more than his grandfather did. So now we have to preach the importance of research; to tell people that of all the factors of production knowledge is one of the most important; to point out the need of a great collective organization for the purpose of carrying out research and diffusing a wide spread acquaintance with the results of research.

We have that necessary organization in the Madras Presidency in the form of the Department of Agriculture. What no single agriculturist can do, by research, for himself, the department can do for them all. But in order that its work may be effective it must be understood by the people, and there must

be close co-operation between the Government department, which is an organ of the whole community, and the individual ryots.

Unfortunately even in the educated part of the community there is a remarkable lack of understanding. Some two years ago I was at Kumbakonam, and attended a meeting of the local Home Rule Association at which a lecture was given on Indian Agriculture, followed by discussion. One of the leading men in the city spoke at that discussion of some new appointments in the Department of Agriculture, and denounced the extravagance of paying salaries of Rs. 500 per month and upwards to Deputy Directors. The only improvements which the department had introduced, he said, which had benefited agriculture in the district of Tanjore, were single transplantation of paddy and growing green manure crops, though these, he admitted, were important improvements. I gathered that if this gentleman had his way under Home Rule, if the department were not shut down altogether, at least only men at very moderate salaries would be appointed; salaries such as would make it impossible to recruit a man trained in any country where agricultural science is more advanced than in India.

Is that a wise attitude? Just let us take the test suggested by that speaker. Suppose that the Department of Agriculture had done nothing else but introduce single transplantation of paddy and the growing of green manure crops, and think what the value of those improvements will amount to when, by the gradual diffusion of knowledge, they are fully utilized, compared with the cost of the department. Remember, on the one hand, that there are over 11,000,000 acres under paddy in the Presidency; on the other hand, that with single transplantation there is a great saving of seed *and* a heavier crop; and that even where green manure can be gathered from adjoining woods and forests the manurial value of a suitable crop specially grown is far greater, and vast areas have no adequate means of getting adequate supplies from woods and forests. I do not know whether any estimate has ever been made of the rupees per acre that these two improvements are worth annually over the eleven million acres under paddy, but at any reasonable estimate you can see that their value is so great that the salary of a Deputy Director at Rs. 500 or Rs. 1,000 per month is a trifle in comparison. In fact the Department of Agriculture is a sort of bank into which the tax-payers of the Presidency can put in annas by way of investment and draw out rupees annually by way of interest. It is the most magnificent investment possible.

Moreover it is not true that the department has only those two achievements to its credit. Still confining ourselves to paddy we have to note that as the results of prolonged single plant selection carried on for years it is now able to offer the Tanjore cultivators improved varieties of the local rice plant, so that they can either have a variety with the same period of growth and a 15 per cent heavier yield, or a variety with the same yield but a shortened period of growth. Leaving rice, there was the introduction of Cambodia cotton, now the best cotton grown on a large scale in India, giving more than double yield of the cottons it has displaced, as well as fibre of a far superior quality. There was, admit, some luck in that, but when a department is making experiments in many directions, it is only natural that it should have unexpected good fortune in some. And luck alone does not suffice, it is necessary that there shall be continually skilful and assiduous work to safeguard the advantages won, to maintain and improve the quality of the foreign introduction, and safeguard it against pests. In the improvement of native cottons again a great triumph has been won at the Koilpati farm, the "Company Karunganis" yielding, by increased yield and improved quality, on an average an extra profit to the ryot of Rs. 20 per acre. These ryots pay about Rs. 1-8-0 per acre

only in kist! There are many other things of which I might spead, the soil analysis of the deltas, the breeding of improved sugar-canes, the operations against palmyra bud disease, and so on, if time permitted. I must be satisfied with recommending you to study the reports of the Director of Agriculture yourselves.

But now I wish to direct your attention to five burning issues of South Indian Agriculture.

There is first the question of *exhaustion of the soil.*

When we take crops out of the ground we take certain elements from the soil itself. If we keep on taking crops without giving sufficient manure to replace what has been taken from the soil we diminish its fertility, and finally the soil is exhausted. In China it is considered gross impiety and neglect of the religious duty due to the earth Goddess not to return to the soil the human excrement which represents the part of the food consumed which came from the soil. I must not speak of Indian sins in this matter without confessing that no country in the world sins so greatly as Great Britain. But here also in Madras every monsoon, when the bar is open, we pour out into the sea a whole riverful of the most beautiful liquid manure. Great Britain has this excuse for its wastefulness, that it imports vast quantities of food from various countries, including much cattle food, which adds to the store of manure, and also gathers great quantities of fish from the sea.

But what are you doing in India? You are exporting the fertility of the soil. Each year the trade statistics show vast quantities of bones exported, and hides and oil-seeds. Export oil, by all means; that is, made by the plant from the air, but beware how you export the poonacs, or oil-cakes, which contain the part of the seed derived from the soil, or the whole oil-seeds containing both the oil and the poonac. In exporting these things you are exporting the fertility of the soil; and especially in exporting bones, which contain matter as indispensible and more difficult to replace, than that in the poonacs.

The second issue is the *question of pests and diseases.*

In dealing with these we have to look to Government, and Government is handicapped by the individualism which is characteristic of human nature, either in India or elsewhere. In Great Britain we have learnt that it is worth while to give Government departments very drastic powers of interfering with individual liberty in order to cope with matters like hydrophobia and swine fever, and cattle diseases, and to make individuals submit to loss and inconvenience for the common good.

Similarly when a plant pest appears it can be combated only by common action systematically pursued by all cultivators under Government direction. . You have doubtless heard that the boll-weevil which has done such harm in Egypt has appeared in the cotton fields round Cambodia; and energetic action is being taken by the Department of Agriculture to get rid of it. The measures prescribed involve a slight immediate loss to the cultivator to which it is necessary that he should submit, in order to save a great common asset. It is most necessary that in such campaigns as these the department should have the support of unofficial members of the Legislature, and of the educated public generally. It is fighting for the general good, and for the welfare of future generations.

Thirdly, there is the *question of adulteration.*

I have been told that whenever the Indian people find that they own a goose which lays golden eggs, they straightway proceed to kill the goose, by their habit of adulteration. There was, some time ago, a man living near Bombay who is said to have made a fortune because he possessed a pit from which he could dig clay of the same colour as Indian wheat, and that he kept a band of women

there continually at work, kneading the clay into little pellets the size of grains of wheat, and sold it to the merchants to mix with the wheat they exported. The results of such adulteration of Indian wheat was that the price fell considerably below other wheats, although Indian wheat is, in itself, of superior quality. There was all the needless expense of adding the earth, of transporting it, and then washing it out again, and all this came, in the end, out of the price received by the Indian merchant and the Indian agriculturist. But while the community as a whole suffers by adulteration, the tragedy is that the individual ryot or merchant who adulterates more than his neighbours makes an individual profit by so doing, and the honest man who hates the practice, and adulterates less, suffers an extra loss, as the reduction of price based on the average amount of adulteration is spread over the whole output. Similarly, when the trade in Indian indigo revived as a consequence of the war, the old practice of adulterating it with mud revived also. What dyer will prefer the Indian product to synthetic indigo in such circumstances? Specially important to our Presidency is the adulteration of hides and skins tanned here. The dishonest tanner can increase the apparent weight of the hide by soaking it during tanning, in Epsom Salts and other similar solutions. The loss falls at first upon the foreign buyer, but he protects himself by refusing to buy from India, or buying only at a specially reduced price. So the whole tanning trade suffers, and is threatened with extinction, unless adequate steps be taken to deal with the evil.

In some cases this can be done by the trade itself, and this has been done in the matter of wheat. But it is a common interest of the whole community that is at stake, and the Government, therefore, as the trustee for the whole community, ought to recognize its duty in the matter. One grieves to say that in some matters attempts to enforce laws against adulteration would only lead to exaction of additional *mamuls* by the police. But whatever laws against adulteration can be enforced efficiently, ought to be enacted and executed. It is proved to be possible in the case of hides and skins, because it has been done during the war. There could be no better omen for the future of Indian industry than the enactment of such a law for the period of peace and its effective enforcement, to be followed by other applications of the same principle, until Indian products acquire a world-wide reputation for honesty, purity, and excellence.

The fourth problem is that of *excessive subdivision of land and fragmentation of holdings.*

This I must pass over, as it is to large a subject to be treated here.

The fifth problem is that of *breeds of cattle.*

Some time ago I wanted to make an estimate of the amount of milk annually obtained from the millions of cows in Madras Presidency. I made inquiries in various directions, and finally worked out some figures based on the assumption that it took, on an average, no less than *twenty-five Indian cows* to produce the quantity of milk yielded by an average English cow. I showed my figures to Mr. G. A. D. Stuart, then Director of Agriculture. He immediately declared that I put the yield of an Indian cow much too high, and his opinion was confirmed by the Agricultural College, and even more emphatically by Mr. Allan Carruth, whose special duty it is to deal with cattle. You can guess, therefore, what a vast field there is for improvement in the Indian breeds.

But are we going to get improvement? Not on present lines. Here also the saying about killing the goose that lays the golden eggs applies. In Britain, when we discover in some part of the country a breed of cattle with special merits, like Jerseys, or Herefords or Devons or Kerrys or Ayrshires, the

breed, through such recognition, becomes more numerous, and more attention is paid to it, and the quality is still further improved. In India, sometimes at least, the opposite result happens. There was a specially good breed discovered at Punganur. When this was generally recognized, and the cows came into demand, all the best animals were sold away from Punganur, and no care was taken of the breed by purchasers, and now the Punganur breed is extinct. I found in Mysore the wide-spread belief that the repute of Mysore cattle is leading to the sale to other districts of all the best bulls, instead of to their retention for breeding purposes, and consequently to the deterioration of the breed; and many people think that the same thing is happening in the Ongole district. It is even, I believe, a *Tamil proverb*, that "the calf of the good cow dies.', If that is true it is a disastrous truth.

We can hardly think of any manner in which a *zamindar* or other large landowner can deserve better of his country than in fostering and improving the best breeds of domestic animals. It is cheering to know that there are men who are now doing this work. I should like to see the value of their services recognized by Government in the annual distribution of honours, so that others may be made aware, not only of the reward, but of the lasting benefit to all future generations of the Indian people achieved by the man who gives us better cattle, or better sheep, or better strains of useful plants.

INDIAN ECONOMIC ASSOCIATION CONFERENCE.

BY A. J. SAUNDERS, M.A., F.R., ECON. S.,

American College, Madura.

THE third Annual Conference of the Indian Economic Association was held in the senate House, Madras, from Dec. 31st 1919 to Jan. 3, 1920. The importance and growth of the Conference is seen by the greater interest and larger attendance of each succeeding year. Calcutta, Bombay and Madras have each entertained the Conference, but by common consent the last meeting of the association at Madras was the very best up-to-date. This was due largely to the splendid work of the local secretary. Professor Gilbert Slater, and his very efficient Reception Committee, who spared neither money nor effort to make the Conference a great success. The Conference also had the support and good wishes of His Excellency, Lord Willingdon, who was to have opened the Conference, but unfortunately had to be away from Madras on the first day; the University of Madras too showed a deep interest in the proceedings, and allowed the Conference the use of the Senate House for all its meetings.

Madras City and Presidency were, of course, largely represented, among those present and taking part may be mentioned: The Hon'bles Messrs. Littlehailes, Paddison, and Macphail, Bishop and Mrs. Whitehead, Mr. Gurymn, I.C.S., Professor Slater, Dr. John Mathai, Mr. Brock, Editor, *Madras Times*, Mrs. Arulanandam Pillai, T. K. Hanumantha Rao, Rajagopalachariar, V. Venkatasubbaiya, P. A. Subramania Aiyar, Rev. P. Carty, S. J. and Mr. A. J. Saunders of Madura. Among those from other Provinces were Prof. J. C. Coyajee and Prof. Arthur Brown (Calcutta), Prof. Percy Anstey, Dr. Harold Mann, Mr. B. F. Madon (Bombay),

Prof. Burnett –Hurst (Allahabad), Prof. C. J. Hamilton (Patna), Rao Bahadur Sardar M. V. Kibe, M.A., and Prof H. W. Lyons (Indore), Prof. Kale of Poona, and Prof. K. V. Rangaswami Aiyangar of Travancore.

The Programme consisted of set papers and a free discussion. A brief resume of the programme is as follows:—

First day—Morning session.

Subject:—The Organization of the Teaching and Study of Economics in India.

Chairman—the Hon'ble Mr. R. Littlehailes, Director of Public Instruction, Madras.

The papers contributed were:—

The Projecting Lantern in the Teaching of Economics, by Prof. H. W. Lyons.

The Study and Teaching of Economics in India, by Dr. John Mathai.

(1) Economic Libraries, and

(2). Economics in the University of Madras, by Mr. G. Satyanarayanamurthi, M. A. The Teaching and Economics in India, by Prof. Percy Anstey.

In the afternoon the members of the Association made a most interesting visit to the Buckingham and Carnatic Cotton Spinning and Weaving Mills. The Management did all they could to make our visit as informing and interesting as possible. We had explained to us the Company's Provident Fund and Bonus System for the work people by which in one typical case one won after seven years of service got a bonus, or straight out gift from the Company, of Rs. 453, I think it was. In another case a won after ten years of service got a gift of over Rs. 650. We were greatly pleased with the model Village—clean, neat, separate homes for the employees, and as one might readily expect these homes are in great demand. We saw the distribution of rice to work people at four measures the rupee, which would cost in the bazaar 2¼ measures for one rupee. In this way the Company is spending Rs. 6,000 a month for the sale benefit of the workpeople.

The Mill School is a wonderful institution. Children of workpeople are given a good education with industrial training, aud many boys who have passed through the School are now skilled workmen drawing over Rs. 100 per month. The Company is truly alive to the need of social and economic betterment of factory work people in India, and is doing a commendable welfare work among their employees in Madras. Tea was served to the visitors in the Mill School, and Prof. Coyajee expressed our appreciation of what we had seen and heard in a neat little speech.

Second day—Morning session.

Subject:—Industrial Betterment and Welfare Work in India.

Chairman—the Hon'ble Rev. E. M. Macphail, Principal, Madras Christian College.

The papers contributed were:—

The Effect of the Rise of Prices on Rural Prosperity, by Dr. Harold Mann and Mr. N. V. Kanitkar.

Organization of Social Service, by Mr. Whitehead.

A Madras Paracheri by Mr. K. C. Ramakrishnan, M.A.

Problem of Paraiyas, in the Tanjore District, by Mr. Arulanandam Pillai.

The Influence of the War on, and Present Economic Conditions of, the Sourashtra Community in Madura, by Mr. A. J. Saunders, M.A.

Housing of the Poor in the City of Madras, by Mr. V. Venkatasubbaiya, B.A.

Industrial Betterment and Welfare Work in India, by Prof. A. R. Burnet-Hurst.

Afternoon session.

Subject:—The Indian Currency Problem.

Chairman Prof. J. C. Coyajee M.A., Calcutta University

There were papers contributed on.

Our Currency Problems, by Mr. B. F. Madon.

Indian Currency, by Mr. J. H. Wadia.

A Plea for the Currencies of the Indian States, by Rao Bahadur Sirdar M. A. Kibe, M.A. of Indore.

The Exchange Problem, by Prof. C. J. Hamilton, M.A.

Third Day—Morning session.

Subject:—Co-operative Purchase and the True Sphere of Co-operative Banks.

Chairman—Prof. Percy Anstey, Principal of the Sydenham College of Commerce, Bombay.

Mr. T. K. Hanumantha Rao made an eloquent speech on Co-operative Purchase in which he outlined the history and wonderful growth of the Triplicane Co-operative Store in Madras. Mr. V. Venkatasubbaiya and Mr. P. A. Subramania Aiyar also participated in the discussion on Co-operative Purchase.

The following papers were contributed on co-operative Banks.

The True Sphere of Central Banks, by Prof. J. C. Coyajee.

The True Sphere of Co-operative Central Banks, by Prof. P. C. Basu.

True Sphere of Co-operative Central Banks, by Mr. C. P. Sundara Rao.

A Business Meeting occupied the attention of the association in the afternoon, when it was decided to hold the next Annual Conference during Christmas week 1920, at Allahabad, U. P.

Fourth Day—Morning session.

Subject:—The adoptation of the Indian Tax Systemto the Need for Increasing Expenditure.

Chairman—Prof. C. J. Homiltan, M.A., of Patna University.

The papers contributed were: Problems of Our After-War Finance, by Prof. K. V. Rangaswami Aiyangar.

Post-War Reform in Finance, by Prof. K Bhattacharya.

British Indian Sea Customs Duties and Indian States, by Rao Bahadur Sardar M. V. Kibe, M.A.

Land Revenue and Provincial Finance by Mr. E. V. Sundara Reddie, M.A., B.L.

Reform in India Taxation, by Prof. T. K. Shahni.

It would be futile on my part to try and summarise such an array of papers on such important schemes as are mentioned above. The papers were of a high order, and the discussions which followed were very helpful. The papers must be read to be appreciated, and just here let me say that the Association decided to print all the papers in one volume.*

In the afternoon a visit was made to the Triplicane Co-operative Store. This new famous society began its work in 1904 with 14 members. To-day it has over 3,500 members and 16 branches throughout the city of Madras. The operations of the society up to the present have been confined to co-operative purchase and sale, but now the society contemplates enlarging its functions to take in co-operative production as well. The latest report states:—

	Rs.	A.	P.
Registered Capital raised to ...	1,00,000	0	0
Paid up Capital	54,566	12	9
Reserve Fund	51,555	3	8
Common Good Fund ...	26,484	7	3
Membeeship	3,559	0	0
Sales for year ending 30-6-1919 ...	4,77,196	14	10

The last item on the Conferense Programme was Tea at Government House for members only. It was a gracious thing on the part of their Excellencies—Lord and Lady Willingdon—to invite the members of the Economic Association to take tea with them at Government House, and it was

* A brief report of the Conference is published in another part of this *Journal* (Ed., M. E. J.)

much appreciated by the large number of members who accepted the kind invitation. His Excellency is very interested in and alive to all the economic questions of the day, and desires nothing more than the true economic development of India.

Every one with whom I spoke said that the Madras Conference of the Indian Economic Association was a great success. The hospitality of Madras has set a high standard for all future hosts of the Conference. The papers contributed and discussions made the programme a most interesting and profitable one. While more than one member said that the social intercourse and visits of inspection were by no means the least important items of a rich and varied programme every one felt that the success of the Conference was due largely to the untiring efforts of and splendid support given to the local secretary—Professor Gilbert Slater, who was the moving spirit of the whole Conference, and to him the Conference of 1919 is greatly indebted.

At a meeting of the Bombay Cotton Brokers Association Ltd., speeches were made stating that the Government control of cotton, which was intended for maintaining a satisfactory level of price of cotton cloth for checking the speculation and organize trade in the ideal way has failed to achieve its objects and worked to the disadvantage of the Indian cotton producers as against the manufacturers and urging that the constitution of the Central Association proposed to be formed by the Government should be by direct election and not nominations.

INTERNATIONAL LABOR CONFERENCE.

By A. T. Marks.

[This is a special report of the Proceedings of the International Labor Conference for the afternoon session of Nov. 19, 21, 1919, received from Mr. A. T. Marks, our U. S. A. Correspondent., —*Ed.M. E. J.*]

Conference reconvened at 2-30 Nov. 19, U. S. Secretary of Labor presiding. He called for the report of committee on the employment of children. Sir Malcolm Delevingne, Great Britain, chairman, first moved adoption of report by Conference, then explained the action of committee. He stated that the committee had kept two objects in view, to obtain real advantage over the existing conditions and to frame proposals likely to meet general acceptance. Notwithstanding minor disagreements concerning the application of the convention to certain countries, the committee was able to reach an unanimous agreement upon the main points of the report. It was determined to fix fourteen years as the minimum age for entering industrial employment. Exceptions have been allowed to this, in order to allow the period of transition in certain countries which are backward industrially. Certain members of the committee desired a higher age than fourteen but it was decided that recognition by the majority of countries included in the Labor Conference would not be possible under the present circumstances if a higher age were named, though it is hoped later the Conference will make additional advances in convention. Other committee members wished to have the convention extended to all employments, but this was not considered feasible at present. The two following matters, however, were discussed on which the committee was unable to reach unanimous agreement:—

1. Question of allowing some exceptions during the transition period in countries where the age of

leaving school is not yet fixed at fourteen it being represented that in those countries the adoption of the proposition leaves a gap between age of leaving school and the admittance to employment, without the possibility of making educational arrangements necessary to fill the gap by continuing education. This was recognized as a serious difficulty, and helped to convince the committee that the date suggested for application of convention—Jan. 1, 1922—should stand.

2. Question of modification to be allowed in countries having special climatic or industrial conditions was referred to a sub-committee, which divided the nations concerned into two classes—(a) Japan; (b) other oriental countries, India, China, Persia, and Siam. The Japanese Government delegate presented arguments on behalf of the Japanese Government, which were accepted. The Committee was, however, placed in the difficulty because of lack of information from other oriental governments, notably India. Two propositions were submitted to the committee for consideration—(a) Limit of age to be fixed at 12, with special considerations for certain industries; (b) matter to be postponed without decision to next year, by which time it is hoped the Indian Government will have a convention of its own framed. If a definite age limit were fixed by the Conference, it might not be approved by the Indian Government. The Second proposition was approved by the Government and the Employers' delegates from India.

Margaret Bondfield, Great Britain, offered an amendment in the name of British workers, to the effect that in the application of the convention to India certain modifications would take effect prohibiting the employment of children under twelve in factories working with power employing more than ten persons, mines and quarries, railroads, and docks. She said that sufficient reason has not been presented for omitting India from the provisions of the convention. The Argument that the Indian Government has not had time to consider matter is a fallacy inasmuch as child labor is a question that has been discussed by the whole world. The principal objection concerns the actual application of convention, however. The amendment has been drafted to exclude all native or small industries and to include those conducted under western methods, where western factory legislation should apply, providing western safeguards. It has been given as a sufficient reason against the provisions of amendment that parents would object; however, the same argument was given in England concerning the introduction of half time work for children in textile mills.

The question of the inability of the Indian educational system to cope with the problem is very serious and grave responsibility for the Indian Government, but such a problem may prove the quick way to speed educational advancement. Quite probable that the Indian Government will turn down both the original, the convention and the amendment, but the mere attempt on the part of the Conference to introduce progressive ideas in India may give the Indian Government some idea of world opinion on the matter.

Atul Chandra Chatterjee, Indian Government delegate, spoke against the amendment to convention. He said that, though the recommendations of the Conference would give an impetus to social advance in India, progress would have to be slow, because, unlike England, Indian parents have in a majority of cases no education. Several provinces of India have passed legislation providing compulsory education and it is hoped that educational advancement will be made, though time will be necessary to secure funds, teachers, and school buildings. Indian delegates have come

to the Conference unprepared along many lines because much material sent out by the organizing committee of the Conference failed to reach India before the delegation sailed. Mr. Chatterjee concluded by advocating the proposal included in the report of Sir Malcolm Delevingne to postpone action regarding India until the 1920 session of Conference.

Warrington Smyth, South Africa, reiterated the importance of considering the relation of caste system to Indian problems, and of remembering the vast population of the country—300,000,000. He cited examples of Indian industrial conditions, notably in Bengal, where coal mines are worked by cheap labor, whole families going into mines and laboring at night, when it is cooler. Mr. Smyth said that it would be impossible to apply the convention concerning mines to a situation such as this, and advocated the adoption of the suggestion that the matter be postponed for one year.

Narayan Mallar Joshi, Indian workers' delegate, supported the amendment proposed by Miss Bondfield. He said that Mr. Smyth half painted a picture of India as uncivilized or half civilized, and reminded the Conference that India had been under control of British Parliament for more than 100 years; hence to accuse the country of lack of progress during that period would be the reflection upon Parliament. Legislation in India is improving year to year, moreover. Mr. Joshi discussed, the application of half time to Indian Industries and stated that the proposed amendment would apply only to certain specialized industries. Mr. Joshi refuted the arguments that children will go on the streets if not employed, by saying that the educational conditions were not as bad as had been pictured by Mr. Symth. He continued that in portions of India where compulsory education had been introduced people had not rebelled against Government, notwithstanding Mr. Chatterjee's argument that it would be difficult to convince parents of the value of the measure. He concluded with the statement that the Indian Government had, despite its plea to the contrary, known that the question of employment of children would be discussed this year, but that Government was endeavoring to secure postponement of action, though influence of Great Britain in favour of the convention would no doubt have effect upon the determination of Indian policy.

WORK AT PUSA, 1918-19.

BY "RUSTICUS."

AS the years go on, the value of the wor which is being done at Pusa become more and more apparent. On the othe hand, the Annual Report of the Researc Institute becomes more and more technica This is only natural as it simply means tha the standard of scientific attainment is eve becoming higher as the experience of the sta of the Institute grows and that it is increasing ly difficult for them to express their result in language which can be understood by th layman. It is impossible in a *Journal* suc as this, which does not cater specially fc scientific readers, to give even the baldes summary of the investigations carried on b Dr. Harrison, the Agricultural Chemis and except in one respect, the same is th case with Mr. Hutchinson, the Agricultura Bacteriologist. Mr. Hutchinson, howeve in conjunction with Captain Hodgkinso R.E., accomplished one piece of work of non-agricultural nature during the year whic should prove of lasting service to India. severe outbreak of cholera in the neighbou hood of Pusa and the difficulty of obtainin antiseptics turned Mr. Hutchinson's atter tion to the subject of sterilization of wate He and Captain Hodgkinson have now dis covered the possibility of producing solution containing from three to four pe cent of available chlorine from purely India materials by electrolysis, thus avoiding th use of imported bleaching powder which in volves a great loss of chlorine in transit an in store. The great advantage of this dis covery lies in the simplicity of the metho by which the solution, which is now know as E.C., can be prepared. It can not onl be made anywhere where electric current i available but can also be made of standar strength merely by reading figures on a

ordinary current meter without expert knowledge either of chemical or electrical methods. We believe, though the fact is not stated in the Report, that the cost of the solution is very small indeed. The difficulty which has now to be overcome is that of obtaining a sufficient degree of stability to allow of storage for such periods of time as may be necessary for the transports to situations where electric current is not available. If this problem can be solved, the reduction in the mortality from cholera which should result will be enormous and bad epidemics should rapidly become things of the past.

The section of the Report contributed by Mr. and Mrs. Howard, the Imperial Economic Botanists, is as usual, the most readable and it is doubtless partly for this reason that their work invariably attracts the greatest attention in reviews of the Annual Report of Pusa. We do not propose to aspire to greater merit than other reviewers by departing from the usual practice but, whilst we have no desire to minimize the excellence of the work which Mr. and Mrs. Howard have accomplished, we feel certain that they themselves would be the first to acknowledge that other work which is being done at Pusa may prove as important in the history of Indian agriculture as theirs. Dr. Harrison's investigations into the action of superphosphates in calcareous and non-calcareous soils and into the action of green manures on paddy or Mr. Hutchinson's investigations into nitrogen fixation may yield results as far-reaching as Mr. and Mrs. Howard's work on wheat, though they are hardly likely to be as spectacular for the Pusa wheats Nos. 4 and 12 continue to spread throughout the country side. The area under them in 1918-19 was estimated at half a million acres and the additional profit to cultivator which accrued from them at 75 lakhs of rupees. Their success is not confined to this country. In New South Wales, in West Australia, and in Uganda, they are coming into general cultivation. They are being extensively tried in South Africa and Nigeria and samples have been asked for by countries as far apart as Canada and Java.

That the cultivator all over India wastes an appalling amount of water is a well known fact which is the despair of irrigation engineers but it has been left to Mr. and Mrs. Howard to frame the best estimate yet made of the extent to which he misuses his supplies. They have demonstrated that excellent crops of wheat can be grown in North-West India on one preliminary irrigation only whereas the cultivator in Sind applies four or more waterings to the standing crop and his brother in Baluchistan six or seven. Mr. and Mrs. Howard point out that the water which could be set free by more economical methods could be used most advantageously for the production of leguminous fodder crops such as lucerne or berseem (Egyptian clover) and that the general improvement in the organization of the local fodder supplies which would follow the increase in the fodder crops would go far to solve the cattle and milk problems and would also increase the supply of manure. It is satisfactory to find that Mr. and Mrs. Howard's work on soil aeration has convinced them that any fears of soil depletion in the plains of India are groundless. They hold that increased rather than decreased yields are to be expected as surface drainage is improved, as erosion becomes checked, as the texture of the land is improved by the extend use of suitable leguminous rotations and as the conditions necessary for nitrogen fixation are elucidated and applied.

Second only in general interest to the report of Mr. and Mrs. Howard is that of the Imperial Agriculturist, Mr. Wynne Sayer. Mr. Sayer's trials with the Fordson motor tractor have attracted much attention which makes it all the more regrettable that Pusa is too inaccessible to admit of more ocular demonstration of its advantages. Mr. Sayer reports that the tractor worked with

implements in use on the farm and did all that it was asked to do in excellent style. It was hitched successively to a double furrow disc plough, a Ransome's cultivator, Cambridge roll and rake of three spring tooth harrows, and was afterwards used to run the silage cutter. Its work over ploughed land was good and thorough and showed no sign of poaching the laud or failing to get a driving grip. Mr. Sayer cautiously declines to express a definite opinion as to the capabilities of the tractor but considers that the experiments so far made with it show that it is an extraordinarily handy machine and its light weight and great power render it well adapted to Bihar conditions and, combined with its low capital cost make the outlook for it in India most promising. But if the Fordson tractors are to fulfil their proper functions in this country, it is essential that a supply of properly trained mechanics should be forthcoming to look after them and that the practice, on which Mr. Sayer caustically comments, of making all adjustments with a hammer and all running repairs with a piece of string should be abandoned. In this connection, it is worthy of mention that, at the recent meeting of the Board of Agriculture at Pusa, a resolution that an Agricultural Engineering section should be added to the Research Institute was adopted. There can be no question of the wisdom of this recommendation. Such a section will be able to keep the manufacturers of tractors and other Agricultural machinery in close touch with Indian requirements and should also be able to prevent this country being flooded with unsuitable machinery or implements. Mr. Sayer's section continues to do most valuable work in regard to the improvement of Indian cattle. The Pusa dairy herd, which is the progeny of Ayrshire and Montgomery stock, is now the most famous herd of its kind in India and the estimation in which it is held is shown by the fact that Rs. 11,850 were realized for seventy animals. This is, however, as Mr. Sayer points out, not a correct index to the value of the herd as the best cattle are naturally kept to breed from.

The work of the Mycological section does not call for special mention as it consisted mainly of a continuation of the researches of previous years. We cannot refrain from a mild protest against the way in which the report of the Entomological section has been compiled. The tendency to refer to other publications, from which it may be noted, in passing, that other parts of the Report are not entirely free, is very marked in Mr. Fletcher's contribution. We are told that a complete roport on the information which has been collected regarding the occurrence within the Indian Empire of any insects which may be utilized as efficient checks on the growth of lantana has been submitted for publication as a memoir. This is a subject of very general interest and some indication of the conclusions which have been arrived at should have been given in the Roport. We are also told that the experiments in regard to grain storage were concluded during the year and that the results were written up in a paper read at the third Entomological Meeting which had also the benefit of a paper embodying the results so far obtained regarding the protection of wood against termites. Again, Mr. Fletcher's investigations into the question of determining the immunity of the varieties of cotton against bollworm attack have shewn that certain varieties appear to enjoy partial immunity but it is not stated what those varieties are. We hold that the usefulness of the Report is greatly impaired by omissions such us these and that it should be a complete record of the work done at Pusa during the year to which it relates.

It is satisfactory to note that the number of visitors to Pusa greatly increased during the year. About 165 ladies and gentlemen visited the Institute, of whom the most distinguished was Lord Chelmsford, the first Viceroy to visit Pusa since the foundation stone was laid by Lord Curzon. The number of visitors to Pusa would undoubtedly be very much greater than it is, if it were not for that inaccessibility to which reference has already been made. If those interested in Indian agriculture can make up their minds to face he difficulties of the journey, they are, as the present writer can testify from personal experience, sure of a hearty welcome and will find much that will interest them greatly. Pusa has accomplished so much under the inspiring guidance of Mr. Mackenna that we would, in conclusion, express the hope that, in spite of the hints of his impending retirement which he gave recently at the meeting of Agriculture, he will continue to direct its destinies for a long time to come.

SALEM IRON ORES[1]

BY MURRAY STUART, D.SC., F.G.S.,

Assistant Superintendent, Geological Survey of India.

IN April, 1919, I was deputed by the Director of the Geological Survey of India to collect a bulk sample of the Kanjamalai iron ore, in order that it might be considered from the standpoint of electric smelting and magnetic concentration. I accordingly collected three different samples from three different parts of the outcrop, each being a cut across the band; two of these samples weighed a little over 3 tons each and the third a little over 5 tons. Before considering these samples I will shortly review the exploratory work that had already been done on the Kanjamalai iron ores.

In 1864, Messrs. King and Bruce Foote published a memoir on "The geological structure of parts of the districts of Salem, Trichinopoly, Tanjore and South Arcot in Madras" and appended to it a short note on the Kanjamalai magnetite iron ores (*Memo.* Geological Survey of India, Volume IV, Part 2, 1864). In this appendix they give a description of the magnetite ore beds, and on page 161 they state—

"In richness the beds are not constant throughout but vary gradually from a rock, which to the eye would appear to consist of ore to the extent of seven parts in eight (the eighth part being quartz, the only mineral associated with the magnetic iron) to one containing about half its bulk of ore; the great mass of the beds consisting of an intermediate quality, ...The ore generally occurs in grains of various sizes lying in the planes of foliation, and sometimes uniting into strings or into small laminar patches......

"........The yield in the furnace, according to information kindly furnished by Mr. Maylor, the Manager of the Porto Novo Company's establishment at Beypoor, is about 55 per cent of iron pig* requiring 13½ tons of charcoal for every ton of iron obtained........

And lower down on the same page, and on page 162

"Workings (of two kinds) may be seen in various places surrounding the foot of the mountain.

The kind almost universally adopted consists of small irregular shallow trenches of holes (rarely more than three or four feet deep) generally in the talus of the beds, but sometimes also on the weathered out-crop, from which the smallest and most friable pieces are collected and reduced to coarse sand by pounding (often with only a round stone) if not found in a state of comminution.

The second method of getting the ore is by rude attempts at shafts,........This second method of working.........is hardly more effective than the first, yielding only a small quantity of the rough ore.........No. 1 bed has of late been worked, chiefly by the first mode for the supply of the Porto Novo Company's works........

The cost of collecting and picking the ore Mr. Maylor states to be..........."

From the above it seems to me that the Porto Novo Company were not smelting the magnetite schist, but magnetite picked out of the weathered and friable portions of the outcrop and talus, after the same had been pounded up to a coarse sand.

Their results in this case would not represent the percentage of iron obtained from the magnetite schist, but from magnetite picked out of the magnetite schist.

The next examination of the ores was made by T. H. Holland the results of which examination were published in Records,

[1] Report submitted to Government of Madras by the Director of the Geological Survey of India.

* Or about 62 per cent of metallic iron of the finest quality.

Geological Survey of India, Vol. XXV, part 3, pages 135-159, 1892. In this report the author writes (page 136):—

"*Magnetite occurs also*, making with quartz, a schist in which the crystals of magnetite are crushed out in the direction of foliation to a roughly almond shape, the proximity of the tapering points giving a lacunar appearance to the rock. Crystals of about one-half to three quarters of an inch in length and of this shape, are common in the iron beds of Kanjamalai.

....All gradations in size are found down to an almost aphanatic rock in which the constituent minerals are, to the naked eye, indistinguishable as individual crystals......." and further on page 137:—

"magnetite is the richest ore of iron, containing when pure, 72·4 per cent of pure iron, the remainder being oxygen ($Fe_3 O_4$)... ......,in the Salem district it is possible to obtain an almost inexhaustible *supply of* ore with an average of nearly 60 per cent iron. This result is calculated from the average *mineral composition* stated by Messrs. King and Foote........I have collected a large number of typical specimens which I hope to subject to analysis........"

A further reference to the specimens collected by Sir Thomas Holland is found in the *Technical Reports and Scientific Papers of the Imperial Institute*, 1903, pages 12-22. The results of the analysis are summed up on page 19:—

"In 1892, Mr. T. H. Holland, Assistant Superintendent of the Geological Survey of India, was deputed by the Government of India to secure for the Imperial Institute a representative collection of the iron ores of Madras......The specimens were accordingly submitted to analysis under the direction of Sir Frederick Abel, and the results published in the *Journal of the Imperial Institute*, Vol. 2, No. 18 (June 1896).........This collection included six samples of ore from Kanjamalai in the Salem district of Madras, which, on analysis, furnished the following results:—

Available iron.	Insoluble residue (silica).	Sulphur.	Phosphorus.
68·93	1·04	·016	·13
70·06	1·72	·020	...
63·57	8·89	·029	...
66·96	3·17	·010	...
36·44	46·95	·010	...
35·73	48·45	·029	·27

........."

and in reference to the above it is further stated on page 21:—

"Four out of the six specimens are undoubtedly excellent samples of magnetite... "

The average ore of Kanjamalai, however, is not a pure magnetite but as stated by Messrs. King, Bruce Foote, and Sir Thomas Holland, is a quartz-magnetite schist, and the above four specimens cannot be regarded as representative samples of the magnetite quartz schist, rather as fragments of magnetite from the schist. With the exception possibly of the last two, therefore, the above analysis from a commercial point of view, mean nothing.

The next important investigation was carried out by C. S. Middlemiss who submitted a report in 1898*. Mr. Middlemiss collected material at intervals of about 2 ft. throughout the entire thickness which he estimated to be about 70 ft. thick of the lowest of the iron ore bands. The 32 specimens which he thus collected were carefully broken out from the centre of unweathered lumps of ore. Two tons of the best of this ore were afterwards selected to be sent to England for testing. The results of analysis on the bulk sample so obtained are quoted

* This report was not published.

in the Imperial Institute report already mentioned (pages 19-21) as follows:—

"A specimen of the consignment of ore specially selected this year by Mr. Middlemiss of the Geological Survey of India, for transmission to Messrs. Bolckow, Vaughan & Co. as typical of the Kanjamalai deposit, referred to in his memorandum of the 6th February 1898, furnished on analysis in the laboratories of the Imperial Institute the following results, which are in substantial agreement with those obtained by Messrs. Bolckow, Vaughan & Co."

The results of these analyses are given as—

	Imperial Institute	Mr. Stead
Iron	38·74	39·02
Insoluble residue (silica.)	44·09	42·36
Lime	·365	1·00
Sulphur	·076	·03
Phosphorus ...	·14	·13

Mr. Stead analysed the sample for Messrs. Bolckow, Vaughan & Co.

The following comments are made on the above (ibid, page 21):—

"We may therefore conclude that if the sample of Kanjamalai ore is, as Mr. Middlemiss asserts, an average speciman of this deposit, this ore cannot be seriouly regarded as suitable for smelting.........Similarly if the sample of Sanctoria coal sent.........I am, however, of opinion that neither of these two points has been established. As regards the ore Mr. Middlemiss remarks: only occasionally, in small pockets or as veins, or local accretions (not more than a few inches across), do we sometimes find masses of pure or almost pure magnetite. But it would not be fair to include these in any estimate of the general richness of the beds. It is doubtless due to some such specimens as these having been gathered that some of the analysis of the Kanjamalai iron ore carried out at the Imperial Institute, gave such abnormally rich percentages of iron (about 70 per cent). Now the specimens of ore referred to by Mr. Middlemiss as having been analysed at the Imperial Institute were selected by Mr. T. H. Holland as typical portions of the deposit."

I would point out here that specimens representing portions of a deposit do not necessarily represent the deposit as a whole, and that the criticisms passed on Mr. Middlemiss' conclusions were not justified. The specimens of magnetite previously analysed represented the magnetite of the magnetite schist, the quantity of it in the schist being accepted by Sir Thomas Holland to be the amount stated by Messrs. King and Bruce Foote. The sample sent in by Mr. Middlemiss was the first actual sample of the beds as a whole to be analysed, and it proved, as the samples now collected by me confirm that the estimate given in Messrs. King and Bruce Foote's report was too high.

Description of the Ore.

As described by Messrs. King, Bruce Foote, and Sir Thomas Holland the ore is a quartz-magnetite schist, ranging in texture from a rock in which the lenticles of magnetite are from one half to three-quarters of an inch long to an almost aphanatic rock in which the constituent minerals are almost indistinguishable to the unaided eye. I carefully looked for the pockets, or veins, or local accretions of pure or almost pure magnetite mentioned by Middlemiss as occasionally occurring in the rock and was surprised to find how seldom they occur and how small they usually are. It was only after a long search that I found any at all, and then they were of insignificant size. That they do occur in the rock is obvious from the fact that the scree and talus from the iron ore band which lies scattered over all the surrounding fields contains occasional fragments

of magnetite. None that I saw were more than a few inches across, and they evidently form a negligible portion of the deposits.

From a heap of screenings at the south-east corner of the hill it seems that, at some time fragments of magnetite have been collected and used for the production of iron. I do not agree with Messrs. King and Foote that some of the band would appear to the eye to consist of ore to the extent of seven parts in eight. My impression was that the rock consisted of rather less than half of its bulk of ore, an estimate that is supported by the analysis of bulk samples. Bulk samples were taken from the lowest and most important band at three different places.

A little over three tons was taken from the bed at the north-east corner of the hill where most work seems to have been done on the deposits.

Another sample of over three tons was taken from a point 100 yards west of the first sample, and one of over five tons from a point at the south-east eorner of the hill. In each case the material was obtained by making a cut across the bed and obviously poor ore, containing one-third or less of its *bulk of magnetite, was thrown away. I* mention this to show that whereas my samples are average samples of the material that would be quarried for commercial purposes, they are slightly richer than a sample representing the quartz-magnetite schist as a whole should be.

Parts[1] of the samples were analysed in the laboratory of the Geological Survey of India, by my colleague Mr. H. Walker, with the following results :—

Number of sample.	*Percentage of iron.*
1	39·03
2	38·6
3	37·12

It will be seen that the sample taken from the point where Mr. Middlemiss took his agrees entirely with the latter, the sample taken by me giving 39·03 per cent iron and that taken by him giving 39·02 per cent iron. It may therefore be taken that the point that Prof. Dunstan held had not been established, namely, that Mr. Middlemiss' sample represented the average of the deposit, has been established completely, and that the estimated richness of the beds, given in Messrs. King and Bruce Foote's report was too high.

That report does not definitely state what was being smelted at that Porto Novo Company's establishment, but from Mr. Maylor's quoted statements it would appear to have been picked material—probably magnetite picked from the schist. Four separate bulk samples have now been taken, one by Mr. Middlemiss and three by me, each weighing several tons and the analysis of these all agree.

TREATMENT AND SMELTING OF THE ORE BY ELECTRIC POWER.

As the distance of the ore deposit from the coalfields of India, or from the coast, prohibited the ordinary smelting of the ore, and as the local supply of sufficient charcoal for this purpose had also proved to be impossible, the suggestion has been brought forward that the ores might be treated and smelted electrically, it being possible to obtain electric power from a proposed hydro-electric power scheme on the borders of Madras and Mysore. The treatment of the ores under this scheme would consist of—

(1) Crushing the ore.
(2) Magnetic concentration.
(3) Briquetting the concentrated magnetite with charcoal and limestone.
(4) Smelting in an electric furnace.

Experiments already carried out on the ore have shown that the preliminary crushing must be exceedingly five to give a satisfactory result. The first point to be considered is whether sufficient charcoal can be obtained locally. The smallest electric smelting furnace that is estimated would pay, is one turning out 60 tons of iron per day. Now the electric smelting of iron ore requires approximately 17 cwts. of charcoal for every ton of iron produced. Therefore

[1] Probably representative of the whole samples.

the daily production of sixty tons of iron would involve the consumption of fifty-one tons of charcoal, and this would mean the carbonization of at least 204 tons of wood daily. The Salem forests have been investigated,* and in 1875 the Madras Board of Revenue stated that fellings in the Salem district had given twelve tons of wood per acre, and that reproduction wood replace this wood in twelve or fifteen years. They estimated therefore a yield of one ton of wood per acre from forest reserves. Subsequent reports gave the outturn as 4⅓ tons, which in a twelve years rotation would give an annual yield of one-third of a ton per acre. The provision of 204 tons of wood daily, therefore, would mean the cutting of 612 acres of forest reserve every day. This wood would then have to be cut up, carbonized, and the resulting charcoal conveyed to the smelters daily. A forest area of at least 224,092 acres would be necessary for the continuous supply of charcoal.

Since the charcoal is the scarce material, the crushing, briquetting, and all the other necessary operations would have to be done by electric power. The amouut that would be consumed in this way would be considerable. The magnetite schist is exceedingly hard and considerable electric power would be consumed in the satisfactory crushing of it.

The electric smelting of iron ores is only just coming into commercial practice. It is now being done in Sweden. At the joint meeting of the Iron and Steel Institute and the Institute of Electrical Engineers held in London on 8th May 1919, Mr. J. Bibby pointed out that the electric smelting of iron ores became commercially sound only when one horse-power year of electrical energy cost less than 2·3 tons of coke (see the report in *Nature*, May 22nd 1919, page 236).

Owing to the low grade of the Kanjamalai ore—practically three tons of which would have to be quarried, crushed, and treated in a magnetic concentrator for every ton of iron produced,—its extreme hardness, and the large area from which wood for charcoal would have to be collected, I do not consider that the electric smelting of the Kanjamalai iron ores lies within the bounds of present commercial possibility.

* See Smeeth, Notes on the electric smelting of iron and steel, Bulletin No. 5, Mysore Geological Department, 909, page 70.

RECONSTRUCTION IN GREAT BRITAIN.

By R. K. Sangameswara Iyer, M.A., L.T.

" Not infrequently war gives rise, not only to new educational ideals, but to new institutions and to new types of institutions favourable to the advancement of science."—Walter Libby.

An anxious era of reconstruction has succeeded an era of devastating war in almost every part of the world; but reconstruction is pursued with almost a feverish energy in those European countries that were directly engaged in the recent great war. Reconstruction appears to be a natural reaction of war; for if we look back to the past, a national reconstruction of education or science invariably owed its origin to a great war or revolution. War itself acts as a great stimulating influence, " in increasing the demand for useful and practical studies. In the activities of naval and military equipment and organization this influence is obvious enough; it is no less real in the reaction from war which impels all to turn with new zest to the arts and industries of peace and to cherish whatever may tend to culture and civil progress." *

Though the policy of reconstruction is at present largely guided by unbalanced winds, distracted as they are by the recent great struggle, yet there is no doubt that in several directions the foundations for a great and prosperous future are being truly and soundly laid. A poor conntry like ours on the threshold of development, may be profited a good deal in its task of construction by carefully scrutinising what is being done by way of reconstruction in the leading countries of the world, and assimilating what is good for its own amelioration.

But, at present, information regarding reconstruction from other countries is meagre

* Libby. *History of Science*; London 1918.

and scattered except in the case of England, where the task of reconstruction is considered so vital and important for national greatness in future, that a separate ministry called the "ministry of reconstruction" has come into existence. Reconstruction in that country appears to be many sided. All are familiar with the thorough changes contemplated in education, on the basis of the recommendations of Sir J. J. Thomson's committee and of several 'experts' in the field. Equally characteristic is the attempt that is being made to protect and foster certain industries, known as the "key" industries, that were brought into existence in the country during the war. Thirdly, the very great attention that is being paid to develop agriculture, forestry and fisheries is remarkable in view of the fact that England is pre-eminently a great industrial and manufacturing country rather than agricultural. Lastly, the universal shortage in coal and oil supply during the war years and after has awakened a keen sense of responsibility and brought about anxious investigations regarding the future 'fuel' resources of England and the British empire on a more careful examination, the policy of reconstruction appears to be inspired by one of self-sufficiency within the empire. Be that as it may, every item of reconstruction is full of interest and I will deal with only a few of those that may be found to be valuable to the general public, as well as to the practical politician.

THE PROTECTION OF 'KEY' INDUSTRIES IN BRITAIN.

It has long been feared, not without reason, that one of the immediate consequences of peace would be to subject England to a flood of manufactured articles from Germany; for it was an open secret that German manufacturers were preparing, by every means in their power, to recover and retain their former hold on the English and other foreign markets. They were steadily accumulating stocks to be "dumped" into Great Britain. If they succeeded in this, the several industries, that came into existence in England during the war years, and with which the national welfare was closely bound up, would come to a precipitate end. The country was quick to recognise the importance of developing such industries and the Government was equally ready to respond to public pressure by the steps it took to foster their initiation and future development. These "key" industries, were mainly those which depended upon the applications of physical science, such as the manufacture of synthetic dye-stuffs and drugs, analytical reagents and other important chemical products, optical glass and instruments, electrical apparatus, magnetoes, and a considerable number of inorganic products and medicaments. As an Englishman puts it, before the war "we had become wholly dependent upon Germany for a large number of articles comprised under these categories, which are absolutely essential to the prosecution of war under modern conditions......Now we have not only truimphed over difficulties well-nigh insuperable, but, as is well-known, we have also in many cases bettered the example of our enemies, and certain of our manufactured articles have reached a pitch of excellence which Germany never attained."

In order that this pre-eminence—the fruit of so much anxiety and toil—might be utilised to the fullest extent, the Board of Trade has already prohibited the importation into the United Kingdom of the above mentioned articles. In addition to this they are taking steps to protect other newer industries such as scientific glassware, laboratory porcelain, etc.

For the advancement of industries in future the "Department of Scientific and Industrial Research" has revised various schemes for the carrying out of which funds are placed at its disposal. With the help of groups of manufacturers nine research associations are already in operation, "eight more have been approved and are only

waiting the license of the Board of Trade, while twelve others are under discussion."

Propaganda work is carried on by the Ministry of Reconstruction by the publication of a number of pamphlets, which are readable by the public, whether directly concerned with industry or not. Again, institutions like the Royal Society and the British Science Guild not only arrange for popular lectures, but also organize in various ways the exhibition of scientific products, so as to bring home to the people's mind the importance of maintaining and fostering the newer industries. One must not fail to mention in this connection the rapid coming into existence of large numbers of research councils and societies of all magnitudes from the International Research Council down to the Glass Research Association.

How far the people of the country have successfully co-operated with the Government in the work of patronising home products and boycotting the German ones, may be appreciated if we remember that within the period of eight months since the signing of the armistice, the German articles imported into England were only valued at £40,000 while at the same time the British exports to that country stood at £16,000,000.

DEVELOPMENT OF AGRICULTURE FORESTRY, ETC.

If we now turn to another phase of reconstruction in England we cannot but be surprised at the very great attention that is being paid for the production of Agriculture and forestry in a leading industrial country. Here is certainly a lesson to be learnt by purely agricultural countries like British India and the Native States, where more than 70 per cent of the population are mainly dependent on agriculture, and where about 30 per cent of the national revenue is from lands.

It appears that agricultural research and education were in a totally neglected condition in that country till the year 1910, when Mr. Lloyd George came to the rescue and appointed the Development Commission.* This commission, organized as it was by Mr. Lloyd George, differed from others of its kind in that it had not only a full share of the usual deliberative functions, but it was also provided with the necessary funds for the promotion of research, and of various schemes calculated to assist the Agricultural industry. From the year 1911 up to 1919 the Development Commission was spending a sum of £50,000 annually, by distributing it to various agricultural institutes and colleges so that they may improve their laboratories and staffs. There is little doubt that this grant saved these institutions from losing their best men, most of whom till then, finding little prospects in their own country were obliged to seek posts elsewhere in the colonies, dependencies or the United States. That the country has already derived considerable benefit from this movement is evidenced by the fact that the present proposals involve an expenditure not of £50,000, but of £400,000 a year on agricultural development.

Since 1911 there has been in existence a scholarship scheme which it is now proposed to extend and strengthen. At present there are some forty permanent posts for research work at the agricultural institutions, offered to men who have distinguished themselves in natural science at the universities; and this number will be gradually raised to 150 in the near future.

In addition to these attempts at forstering the intensive cultivation of agricultural science and industry there is also a scheme for the general development of agricultural education throughut the country. At present there are a dozen agricultural colleges in England and Wales alone, but the link between the Agricultural college and school is not very definite. The work of the

* See for instance an article by E. T. Russell in *Nature*, Vol. 103,227.

colleges is now mainly related to the needs of the coming generation of farmers. It is proposed, however, to bring them into closer touch with men at present farming by the establishment of domonstration farms and other organizations. For example it is proposed to erect more 'farm institutes,' where intelligent boys can go for winter courses and girls can be taught in summer; a certain amount of this kind of work has been done and its value demonstrated. Finally there is *provision for giving short courses to school* teachers, who will be engaged in the new continuation schools in rural districts.

While such is the scheme for the development of agricultural industry, research and education, that for the improvement of forestry is no less remarkable.

The Forestry Bill that was before the houses of parliament was a Government measure based upon the reports of a Forestry Sub-Committee appointed by the Minister of Re-construction. The Bill creates a Forestry authority consisting of a few commissioners "charged with the general duty of promoting the interests of forestry, the development of afforestation, and the production and supply of timber in the United Kingdom." The commissioners will have powers to expend £3,500,000 during the next ten years in afforestation. They have very wide powers; this large sum of money is at their absolute disposal and will be subject to no control by Parliament or Minister. Further they "may acquire land, cumpulsorily if necessary, and may plant trees themselves, or aid, by loan or grant, owners of land to plant." It is expected that within the next ten years, nearly a quarter of a million acres will be planted, while the afforestation of 1,750,000 acres is contemplated in 80 years. Also an amount of £6,000 is to be set apart annually for research in forestry.

Attempts in various directions are being made to improve the condition and supply of several important articles of daily consumption, within the United Kingdom and the British Empire. The institution of Department of Fisheries, the investigations as to "the possibility of growing New Zealand flax on a commercial scale in the British Isles," the appointment of Sugar Commission to investigate the possibilities of increasing the sugar production of the Empire, are instances in point.

THE FUTURE 'FUEL' SUPPLY OF ENGLAND AND THE EMPIRE.

During peace as well as war, every modern country consumes large quantities of petrol. The demand for that commodity is increasing day by day to meet the growing needs of motor transport by road, sea and air. The annual importation of petrol into England rose to more than 100,000,000 gallons before the war. At present about 150,000,000 gallons of petrol are imported yearly; most of this comes from the United States, which country, again, consumes not less than thirty times this quantity. In view of the world shortage of petroleum and the enormous increase in consumption of petrol in the United States, it is naturally feared that in a few years England would have to face a shortage in petrol, if not actually a petrol famine. In view of these considerations an Inter-Departmental Committee was appointed to consider the feasibility of a substitute for petrol. The labours of the committee have already been crowned with success. They have found that alcohol from potatoes or the sundried flowers of the Indian *Mahua* tree, might be successful as a substitute. It has been worked out, that while potatoes yield 20 gallons of alchool per ton, the *mahua* flowers yield as much as 90 gallons per ton. Here, as in so many other cases, "the raw material comes most abundantly and most economically from the tropics." These investigations thus indirectly bring about the possibility of developing a new industry in India.

The coal problem of the future is equally serious. In the words of Sir A. Parsons,* "England owes her modern greatness to the early development of her coal. Upon it one must continue to depend almost exclusively for heat and source of power, including that required for propelling her vast mercantile marine. Nevertheless she is using up her resources much more rapidly than most other countries are consuming theirs" and before long there may be an exhaustion of, at any rate, the richer seams. So that failing new and unexpected discoveries in

* Inaugural address before the Bournmouth meeting of the British Association, Sep. 1919.

science, "the great position of England cannot be maintained for an indefinite period." To ease the situation a little, it is proposed to harness the water power to a greater extent in England and in the Empire.

According to the latest estimates, the total amount of available water-power in the British Isles is only 1,500,000 h. p. of which more than 2,000,000 h. p. have already been harnessed. In the rest of the British Empire there are upwards of 30,000,000 h. p. and in the remainder of the world at least 150,000,000 h.p., so that England herself possesses less than one per cent of the water power of the world—a statement not very encouraging.

As to the possible new sources of power, Parsons himself suggests an ingenious alternative which appears to merit attention. He proposes to utilise the great internal heat energy of the earth by sinking shafts to great depths. This does not appear to be a mere speculation if it is remembered that " in Italy, at Lardarello, bore-holes have been sunk which discharge large volumes of high pressure steam, which is being utilised to generate 10,000 h.p. by turbines."

Less ingenious methods for conserving the existing coal supply are adopted on the recommendations of committees* and experts; among which may be mentioned the invention of improved furnaces, reports, etc., in *steel manufacture by which the quantity of* coal consumed is considerably diminished, and the attempt at "the production of a smokeless fuel, with the object of abolishing the smoke nuisance and also of saving the valuable volatile products which are wasted in burning coal."

I have just attempted to give some idea of some of the aspects of reconstruction in a great country. It would now be clear that the problem of Reconstruction in England is many sided; indeed its variety is only equalled by its complexity and stupendousness. The ordinary mind might even be reminded of the old adage of "too many irons in the fire," but in this instance, I am sure, as I wish it to be, that everyone of the iron pieces in the fire is fairly well cared for.

* The number of Committees, Commissions, Councils and associations that have come into existence in England, in connection with Reconstruction, is really bewildering. Apart from the organizations mentioned here, I have been able to count not less than twenty more.

EXPERIMENTAL CONVERSION OF CRUDE-LAC INTO SHELLAC ETC.

By L. S. Subramhanya Iyer, B.A.,
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THE uses of shellac are various, as already enumerated in my Note on the "Mode of Preparing Seed Lac from Crude-lac" published in the *Mysore Economic Journal* for November, 1919. For most of the uses to which lac is put locally, it is used in the form of *Avalakki Aragu*, an impure kind of lac in the shape of small irregular buttons, in which form it is sold in bazaars. This lac is unsuited for *Lacquer Industry, Sealing Wax,* etc., as it contains impurities, such as remains of insects, bark and wood. For such industries pure and refined shellac is required. In Channapatna alone about 2,000 lbs. of refined shellac imported from Mirzapur is consumed annually by Lacquer Industry, but whether it is used in any other parts of the State for industrial purposes is not ascertainable. There are indications of the local demand for refined shellac increasing rapidly while demand for it from Western Countries is also going up. It is unlikely, therefore, that its future prices will fall so low or fluctuate so greatly as in the pre-war days. Hence there seems to be great scope for not only improving and further developing the production of Lac but also for starting a *Shellac Factory* for convertion of the raw-lac now produced in the State.

With a view to study practically the methods of manufacture and to collect data regarding percentages of yield of lac-dye, pure lac-resin and shellac, and their qualities, experiments were conducted on a small scale in the Special Forest Office. The results of these experiments are given below.

Four kinds of crude lac, *viz.*, *Sagade* (Kusam), *Muttuga* (Palās), *Chotte* (Ghont) and *Jalari* were experimented upon. Of these, the Kusam lac was grown in Lakkavalli, being the result of the *4th generation* of brood-lac originally imported from the Central Provinces, and Jalari lac was grown near Bannerughatta and Puttenahalli in the Bangalore District. The other two kinds were obtained from the Central Provinces as brood-lac for propagation in the State, but owing to delays in transit, the lac-insects were dead.

Method of treatment was briefly as follows:—The samples of raw lac received were first weighed and then cleaned of all extraneous matters such as bits of bark and wood by hand-picking, sifting and winnowing. The weight of such foreign matter was ascertained. The cleaned crnde-lac was pounded, passed through sieves of different fineness and sorted into different grades. These latter were then washed repeatedly with fresh water until all the dye was extracted. The last wash was with a dilute solution of sodium carbonate 2 per cent to remove any traces of dye adhering to the lac.

LAC-DYE.

The wash liquor of all the washings was filtered through cloth into a pot, and the water evaporated out until the dye was left at the bottom. To keep the cost of evaporating the water as low as possible, the minimum quantity of water compatible with as complete removal of the dye as practicable was used in washing. The suspended impurities in the wash-liquor remaining on the filter cloth were removed, washed, dried and weighed.

Any fine particles of lac-resin and extraneous matter escaping through the cloth filter with the dye-liquor, constitute the only impurity in the dye. Such impurities are much less when cloth-filters are used instead of wire gauze sieves, but this being a much slower process than sifting or straining in a sieve, the latter is adopted in dealing with large quantities, especially so when there is little or no demand for *lac-dye*. Samples of the dye obtained from the four kinds of crude-lac were all dark in colour with a tinge of coppery hue.

The *lac-resin* after being thus thoroughly washed and dried in shade formed the "*Seed Lac.*" In this stage it still contained a small percentage of impurities removable only by dissolving it in hot alcohol and filtering.

The percentages of such residual impurities calcualted on the weight of the original crude-lac are shown along with those of lac-dye, seed-lac, etc., in the subjoined table. The figures given represent the averages of more than one experiment with each kind of lac, except that of *Muttuga* with which only one experiment could be made from the available crude-lac.

No.	Particulars.	Jalari	Sagade	Muttuga	Chotte	Remarks
		Shorea Talura	Kusum	Palas	Ghont	
1	Bark, wood, and other vegetable matter in crude-lac separated by hand-picking and winnowing. ...	Per cent 5.5	Per cent 10.5	Per cent 15.5	Per cent 10.0	
2	Foreign matter such as the remains of dead lac and predacious insects, vegetable dust, etc., separated by washing	10.6	9.6	10.0	8.0	
3	Earthy matter settling down in washing	.9	1.0	1.5	2·0	
4	*Lac-dye obtained*	*7.1*	*3.5**	*6.0*	*7.0*	
5	Foreign matter separated from seed lacs by winnowing and extraction of resin by hot alcohol	5.5	5.0	5.0	5.0	
6	Quantity of *pure resin*	64.5	66.4	62.0	62.4	
7	Wastages during the course of the several operations	5.2	4.0	4.0	5.0	

PREPARATION OF SHELLAC.

The *Seed-lac* obtained as described above was dissolved in hot alcohol (60° O.P.) and filtered. Experience has shown that seed-lac stored for some time (three to four months) requires four to five times its own weight of alcohol to dissolve it, but when previously soaked over night in water, about three times its weight of alcohol will suffice. The solution obtained was evaporated over a slow fire until the lac-resin remained in the receptacle in a molten state. The molten lac was then dashed on to a tinplate and drawn into a sheet, but when the sheet cooled, it stuck to the tin surface. A porcelain cylinder containing hot water would suit better. In the absence of suitable appliances of a lac-refinery for drawing out the shellac into thin sheets, the molten lac had first to be made into thick sheets and then drawn over a fire into thin flakes. This was a tedious and slow process quite unsuited for adoption in a commercial factory.

The samples of shellac resulting from the experiments were displayed in the last Dasara Exhibition at Mysore.

A sample was also sent to the Secretary of the "Co-operative Lacquer Works" Chennapatna, for testing and valuation. He valued it at Rs. 100 a maund of 80 lbs. while the Mirzapur shellac was sold at about Rs. 200 a maund. This low valuation was due to our shellac being darker in colour than Mirzapur lac and consequently less suited

*N. B.—The crude Sagade-lac which yielded only 3·5 per cent of dye had been used as brood-lac and afterwards stored for over eight months in the office, hence the low yield of dye. Another sample of Sagade lac which had been tied on to trees from end of June to middle of August 1919, thus being exposed to heavy rain and sun for seven weeks yielded no dye and contained only 11 per cent of impurities removable by mechanical processes and 4 per cent by alcoholic extraction of the resin. The *pure resin* content of the sample was therefore 85 per cent. This confirms Mr. Fraymouth's experience that stick-lac when used as brood lac on trees gets cleaned and bleached by exposure to sun and rain on the trees, and that therefore it is advisable to use a whole fresh crop as brood before being brought down the trees, unless the lac-dye is a paying bye-product.

for finer shades of colour. The darker colour of our shellac was due to (a) to the melting of the *lac-resin* over direct fire instead of heating it by steam, (b) to the employment of 60° O.P. alcohol instead of absolute alcohol or wood spirits, and (c) to the primitive appliances used in the preparation.* Later experiments resulted in making lighter coloured shellac, but the quantity prepared was not large enough for commercial valuation. Small samples of shellac and lac-dye, have, however, been sent to the Deputy Director of Commerce for testing and valuation by local users of both.

Experimental Preparation of Sealing Waxes.

This was undertaken with appliances *locally improvised* and consequently far from efficient, steam-jacketted pans and suitable moulds not being readily procurable locally. After repeated experiments with different ingredients in varying proportions, satisfactory *recipes* have been arrived at for making tolerably good *sealing waxes* which are believed to stand the stationers' tests. Wafers obtained from them compare favorably with those of imported sealing waxes showing the impressions in bright and clear relief. Different coloured sticks were made and exhibited at the last Dasara Exhibition.

The method adopted for making the sticks was briefly this:—

A few moulds made of tin sheet, two or three enamel cans, a stove and a ladle were all the apparatus that could be locally procured and used in making the experiments.

Pine-rosin was first melted in a can and then turpentine (Oleo-resin) gradually added. Lac-resin in the form of picked seed-lac was added, keeping up a gentle heat, the mixture being constantly stirred. The other ingredients finely powdered were mixed tegether well and gradually added to to the molten liquid and constantly stirred. When the composition was well mixed and of a suitable consistency for being poured out into moulds, oil of turpentine being used for regulating the consistency as required, the mixture was ladled out into the moulds. After the sticks cooled, they were taken out, trimmed and polished by superficial melting over a gentle fire. If trade-mark or makers' name is required to be impressed on the sticks, it could be done at this stage, if it was not engraved in the mould itself.

Some of the *recipes* worked out in the course of the experiments (based on those of "Spon's Workshop Receipts") are given below:—

* The 60° O.P. alcohol locally obtainable, contains about 9 per cent of water in it, which remains in the lac when alcohol is evaporated away from solution. This water is driven off only by protracted and vigorous heating which has a darkening effect on the colour of shellac. Absolute alcohol which contains little or no water (commercial absolute alcohol contains less than 0.5 per cent water) would suit better than 60° O.P. alcohol. Better than both these is strong wood-spirits (methyl alcohol) which, boiling at a lower temperature than alcohol, is more easily driven off from solution than the latter, with the result that the shellac comes out much finer in colour. So the best solvent to be used in the manufacture of refined shellac is *strong wood spirits.*

Want of facilities for dehydrating the available alcohol necessitated the use of the latter in the experiments.

RECEIPTS.

	Reds		Blues		Yellow		Greens	
	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2
Shellac or clean seedlac ...	3 parts	½	3	1	3	2½	3	1
Turpentine (Oleo-resin) ...	1	¾	1½	1	1½	3	1½	1
Oil of turpentine ...	¼	–	a little		a little		a little	
Rosin	1		1	¾	1	1½	1	1½
Colour	2½ (Red Lead)	½	1 (Victoria blue)	½	1½ (Lead chromate)	½	1½ (Mixture of blue and yellow)	¾
Plaster of paris	¾	½	¾	½	¾	1	¾	½

For red coloured sticks which are the most common ones *cinnabar* is used as a colouring agent for finer qualities and *red-lead* for ordinary ones. For yellow-sticks *lead-chromate* is used and for blue *ultra-marine*. *Berlin blue* is used for superior blue-sticks. Green of any required shade is obtained by mixing yellow and blue colours.

The above method is of course primitive and unsuited for making nice sticks on a commercial scale. Further trials on a larger scale with more suitable appliances have to be made to collect data necessary for considering the manufacture of *Sealing Waxes* and *Shellac* on a commercial basis.

[Note by Rao Saheb M. Rama Rao, Special Forest Officer.—The foregoing interesting note clearly indicates the possibility of manufacturing locally *Shellac*, *Sealing Waxes* and *Lac-dye* from the indigenous crude lac grown in the Country. Almost all the raw material produced is exported and the prices realised hitherto have been too low to induce our Lac-farmers to take any active interest in enhancing the outturn and improving its quality. Our average annual exports during 1913-14 to 1917-18 were 828 maunds (local) valued at Rs. 5-12-7 per maund, while our imports were 358 maunds valued at Rs. 6-10-10. During the same period the average values realised for all-India exports of unmanufactured lacs were Rs. 7-4-5, and Rs. 14-9-11 per maund, respectively. Our crude lac fetched Rs. 1-7-10 less than all-India crude lac, while it fetched Rs. 8-13-4 less per maund than manufactured lac. The cost of manufacture on a large scale would certainly leave a much larger margin of profit than what was realised for our raw material. At present the prices of both manufactured and raw lacs are very much higher, the former being Rs. 45-8-0 per local maund at Calcutta (November, 19) while the latter (crude lac) is now selling in our local market at about Rs. 15 per maund. Our importers of *Shellac* and *Button lac* for Lacquer industry in Chennapatna had to pay Rs. 59¼ and Rs. 68¼ per local maund in September, 1919. Such exorbitantly high prices that our artisans have to pay for imported shellac naturally discourages the Lacquer Industry in the State, while the low prices realised for local crude-lac discourages our Lac-Farmers.

The above facts and figures point to the necessity and importance of taking needful measures to start a *Shellac Factory* in the State for utilising the locally-grown lac, thereby giving a great impetus to the development of lac-cultivation on the one hand, and of Lacquer industry on the other. The experimental cultivation of Kusam-lac introduced at end of December, 1917, on Sagade trees has become well established in Lakkavalli forests and holds out promise of success if extended to other forests where this species of tree is found. Further experiments with *Palas lac* on Muttuga and other trees in the Bangalore, Mysore, and Kadur districts are being tried and there is no reason to despair of their success.

In these circumstances, it is proposed to undertake further investigation of *Shellac*, *Sealing Wax* and *Lac-dye* industry on a semi-commercial scale, and an estimate for the purpose is under preparation.

Since writing the above an estimate has been submitted to the Chairman of the Board of Industries and Commerce.]

GOVERNMENT AND SCIENTIFIC SERVICES IN INDIA.*

By Sir P. C. Ray, D.Sc., Ph. D.

WE stand to-day at the threshold of a critical period in the history of our country. The war has happily terminated, and we are in the midst of rejoicing over the Peace Celebrations. It has been truly said that the late war called for every ounce of scientific knowledge and effort, that the great nations have been straining their utmost and that the scientific battle has been fought by the laboratory men. Indeed, it was from the nitrogen of the air out of which Germany manufactured synthetic nitric acid and thus defied the world for four years and more in spite of the stringency of the blockade. It is now becoming abundantly clear that the fate of a nation will henceforth depend more upon the achievements of its students of science than upon the skill of its generals or the adroitness of its diplomatists and statesmen. Let me illustrate what I have said by a concrete example. The first thing which America did, when she joined the Allies, was to initiate a census of chemists, and in July 1917, a fully detailed description was available of some 15,000 chemists resident in the State, and a research staff consisting of 1,200 technical men with necessary assistants was enlisted for the research division of the chemical warfare service alone.

Peace hath her victories no less renowned than war. The sudden and unexpected stimulus which chemical research obtained during the war has been the means of calling into existence a trained band of workers especially in the Allied countries. In England, for instance, vigorous attempts are now being made to manufacture dyes and fine chemicals backed by heavy subsidies from the state and countervailing duties. It now transpires, however, that Germany, though worsted in the war and her resources enormously crippled has had her chemical plants practically unimpaired and her army of chemists undiminished in vigour. It is suspected in fact that she is already putting forth mighty efforts to oust her rivals and capture her lost markets. England's pre-occupation has also been America's opportunity. During the first three years of the war, secure in her envied neutrality, she reaped a golden harvest by selling raw materials and munitions to the belligerents, and her chemical industries have got such a fillip that in the near future the Indian market bids fair to be flooded with heavy and fine chemicals and dyes manufactured in America. By a bitter irony of fate, England has materially helped America in this respect.

Emerson says somewhere that a chemist will readily confide his secrets to a carpenter, secrets which he will not impart to a brother chemist for all the world. The accumulated experience of generations of English and French chemists was thus gained by America at almost a bound. Japan has not been slow in stealing a march over us: her volume of exports to India has trebled within the last two or three years. The question now arises; Where does India stand in this formidable world competition? My answer is, nowhere. It is sad to reflect that nothing short of the cataclysm of the late Armageddon could rouse us from our stupor and make us realise that like so many other countries, India must be not only self-contained in the production of her own requirements, but learn to convert vast supplies of raw-materials into manufactured products. India has now an enormous amount of leeway to make up. We must now put forth all our energies and make vigorous and sustained efforts so as to be able to stand a fierce world competition.

* Presidential address delivered to the Indian Science Congress at Nagapur on 13th Jan, 1920.

INDIANISATION OF SCIENTIFIC DEPARTMENTS.

After pointing out that want of general education is a bar to scientific progress, the President continued: I feel it my duty to take a rapid survey of the future of science in India, and suggest steps which ought to be taken for the proper culture and development of science in India. By this I mean that educated Indians should take a greater part in original investigations, and steps should be taken for the diffusion of scientific knowledge among the rank and file of the people. The cultivation of science must be entrusted, as is the case everywhere in the civilised world, *to the professors in colleges and universities*, to the teachers in the secondary schools, and to the officers in the various scientific departments of the State, and there must be a good proportion among the *intelligentsia* in the country to take interest in the pursuits of science and encourage its votaries. The visions of the early educationists, in this respect, have proved quite illusive; the contribution to science by Indians has been extremely meagre. Japan entered the race some thirty years after India, but by what a vast distance she has left us behind! Within the short period of forty years, she has built up an educational system which is the admiration of the civilized world, while her contributions to science have been very valuable, and are daily growing in volume and importance.

Let us now see where the fault lies. The Scientific Services of the Government are posts of great value, prospect, and security; they afford to their holders unique opportunities, rare and valuable materials, for study and investigation. But with what studied care the Indians are excluded from these *Services will appear from the following* table compiled from a recent Government report:

The following Table shows the composition of the existing Scientific Services.

Name of the Service	Europeans	Indians	OFFICERS AVERAGE PAY (IMPERIAL GRADE) OF European	Indian
Botanical Survey ...	2	0	1,000	0
Geological Survey ...	16	0	1,010	0
Zoological Survey ...	3	1	970	700
Agricultural Service ...	38	5	1,000	460
Forest Service ...	9	1	1,040	660
Medical and Bacteriological Service (on Civil Employment) ...	24	5	1,220	520
Indian Munitions Board	11	1	780	300
Meteorological Department	10	2	970	770
Veternary Department (Civil) ...	2	0	1,100	...
Education Service * ...	34	3	910	490
Indian Trigonometrical Survey	46	0	..	...

* The Indian personnel has been recently strengthened by certain fresh appointments.

All of these officers except one are Royal Engineers, and hold military rank. The provincial service, which is also highly paid, consists of 112 officers, of which nearly 80 per cent are Europeans and Anglo-Indians, without any academic distinction.

Among the occupiers of these posts, there have been many distinguished European servants of great name and fame. I do not for a moment wish to minimise their achievements. The credit of their work, however, belongs to their own native countries, and the results of their experience are enjoyed by their own countrymen. I shall try to make my point a bit clearer. The Indian lives and moves and has his being in the midst of his own people; the European, somehow or other, lives in a world apart, and from his exalted position of aloofness and isolation fails to inspire those who may happen to come into

contact with him. Moreover, the European, when he attains the age limit, retires to his own native land, and the accumulated experience gained at the expense of India are lost to the country for good. In a word, the present system arrests Indian intellectual growth and inflicts a cruel wrong on India.

In Japan, on the other hand, western experts were at first imported for organization of the scientific services; but they have gradually been replaced by the Japanese scholars. Japan can thus shew an Omori in seismology, a Kitasate in bacteriology and a Takamine in biological chemistry, not to mention a host of other eminent names.

In India, however, taking, for example only one instance, the Trigonometrical Survey is entirely reserved for and manned by Royal Engineers with military rank. I do not see why this should be the case. In England, France, and Germany, civil graduates with scientific qualifications are being employed in increasing numbers. Even in India, in the early fifties of the last century, we find that Radhanath Sikdar, an alumnus of the old Hindu College, was the right-hand man of Colonel Everest, of the Trigonometrical Survey, from whom the highest peak of the Himalayas has derived its name.

In order to make India self-contained, the Government has proposed to institute a Chemical Service. Probably in the near future, departments of aerial navigation, marine engineering, including naval architecture, will have to be organized. The utilisation of Indian brains in these departments should be regarded as pivotal.

Coming now to the second point, *viz.*, the contribution to science by Indian professors, the result has been disappointing so far as the Government service is concerned. And for this the service system is responsible. Take for example the Chairs in the Presidency College of Calcutta, probably the premier College in India. The Chairs are as well paid as any in the world, and the advantages and facilities afforded to the professors are the best available in India. There is sometimes the honoured tradition of an Eliot or a J. C. Bose or a Pedler connected with some Chair. Naturally when a vacancy arises, the aim should be to fill up the posts by able and enthusiastic workers on the subject so as to preserve the tradition and the continuity of the fame attached to such a post. But what happens under the service system? Either a raw, untried graduate is brought out from England or it automatically falls to some senior man in the service whose only title to the post is his seniority, which often goes hand-in-hand with senility. In ninety-nine cases out of hundred, the successor so chosen, has no single original work to his credit, and may have lost all touch with the progress of his subject. Enormous facilities at his disposal thus remain unused as long as he encumbers that post.

It would be interesting to examine the condition of things in such free countries as are unhampered by hide-bound and fossilized system. At Cambridge Rayleigh succeeds Maxwell, J. J. Thomson succeeds Rayleigh, and Rutherford succeeds J. J. Thomson in the post of Cavendish Professor of Physics. Again take the method of selection of College and University professors in Italy as described by Dr. Young:—"The Committee of the most famous professors in the subject in which the Chair is vacant, appointed by the Government *ad hoc* to report on the various candidates, is only allowed to consider the *work done by the candidates* during the five years immediately preceeding the election. And it is only in the case of candidates of world-wide reputation that work anterior to this period is even tacitly assumed. The excellence of this procedure has secured for Italy a succession of brilliant professors, who more than hold their own, when the resources of the country are considered."

The selection of men for professorships in our country lies entirely in the hands of a few big officers. In the case of the lower services, it is the India Council. It is a

continuation of the old Nawabi system. Generally the Directors, or the officers of the Selection Bureau, are men who might have achieved some academic distinction at some period of their career (but this is not always necessary), but having taken to administrative work for long years, are *entirely out of touch with the progress* in the different branches of knowledge. Such officers are by habit and temperament unfitted to judge the merits of rival candidates, and generally very unfortunate selections are made. The evils of the present method of recruitment to the posts of Professors have been pointed out by the Calcutta University Commission who have suggested organization of teaching work on a professorial rather than on a service basis.

The authorities in this country are never tired of singing the praise of men trained in the West. In practice, however, even a third class man of London, or a pollgraduate of Oxford or Cambridge is perferred to the best of Calcutta graduate including Premchand Roychand scholars, or Doctors of Science and Philosophy,—men who have proved their merit by publishing original works in the pages of the journals of learned Societies of the West. The folly of appointing a raw, untried graduate to the charge of a College or University Chair is thus expressed by Dr. Young :—

" In England, on the other hand, a large proportion of the Chairs at the chief Universities are held by men who, at the time of their appointment, would have been regarded on the continent as, at best, promising young students. These men have continued to hold the same posts for twenty years or more, and will continue to hold them till the time comes for their retirement when such retirement is obligatory. *Some of them will die* in harness and will, at the moment of their disappearance from the scene, still have nothing to point to but their original academic success at Cambridge. There are, of course, notable exceptions, but it is still unfortunately the case that the majority of professors and lecturers in the Universities and Colleges of England are men of this type."

POTENTIALITIES OF INDIGENOUS TALENT.

A signal proof of what can be done by Indians, when they are allowed to work under a healthy and free atmosphere, is afforded by the University College of Science, Calcutta. This College grew out of the magnificent and princely gifts of Sir Rash Behari Ghosh and the late Sir T. N. Palit, and was established in 1916; but owing to limitation of funds, the laboratory, the library and the workshop could not be properly organized. In spite of these dicouraging conditions, it is the only institution which has shown anything like life and activity as evidenced by the output of original contributions published in the leading scientific journals of England and America. During the academic year 1918-1919, there were seventeen original contributions from the department of Applied Mathematics, twenty-four from the Physics department, and twenty-one from the Chemistry department. Yet this promising institution is treated like a charity boy by the Government and has had only miserable doles ladled out to it.

What little has been done by them only goes to prove their potentiality, their latent capacity for the work to be undertaken in the future. It is, therefore, necessary that steps should be taken to allow Indians to stand on their own legs. They should not be in perpetual leading strings. The policy which has hitherto been the guiding principle is that everything should be done for them and *nothing by them, and this goes to explain* their virtual ostracism from the higher responsible posts in the various Scientific Services. A vast amount of ability and potential energy is thus allowed to run to waste. Japan has all along followed a course which is the very reverse of that adopted here and with what happy results I need not say. A self-contained India, such as the Indian Industrial Commission looks forward to, presupposes that the experts, specialists and workers which the industrial awakening would demand should be created within her own borders.

Considered from every point of view the progress of scientific knowledge is imperatively

necessary to our individual and national growth. For the accomplishment of this object the whole-hearted co-operation of both the Government and the people is indispensable. While the Government must be more liberal in its grants for the cultivation of science our public-spirited and patriotic countrymen have also a duty to perform. Science owes a great deal to the millionaires of the world. In our country too the examples of Tata, Palit and Ghosh are not wanting. I stand on the platform of a city which is the home of a thriving cotton-industry. Here we have merchant princes and successful mill-owners and business-men. The great philanthropist, Andrew Carnegie, himself a self-made man, acted on the motto that "to die rich is to die disgraced" and gave away more than one-hundred crores mainly for working-men's reading rooms and research institutes. I appeal to our wealth and eminence to follow in the footsteps of the great benefactors of men and I am sure that with their help the cause of science will flourish. The colleges where, at present, Indian voteries of science carry on their modest and humble researches have got to be multiplied many times over. More attention should be given in each University now existing in the country to the cultivation of pure science, particularly physics and chemistry, and more colleges and institutes should be established all over the country for the study of applied science. It must not be forgotten that the present industrial paralysis of the West offers a golden opportunity to the East to wake up. And if India by the grace of God, will avail herself of this opportunity to raise equal to the occasion, if her men of science and industrial pioneers will put their shoulders to the wheel together, if the study of physics and chemistry, of mining and engineering, of marine and aerial navigation and of the biological sciences will succeed in enlisting on their behalf the energy and enthusiasm of thousands of votaries, if the young men of the middle classes will crowd in great numbers the science colleges and the technological institutes more than the law colleges, if the scientific services of the State be thoroughly Indianised, if her rich men will award more scientific scholarships and establish technical schools, India will not take a long time in coming to the forefront of nations and making her political renaissance not a dream but a reality.

MYSORE EDUCATION MEMORANDUM.

By S. SEETHARAMAIYA,

Member, Mysore Legislative Council.

BEFORE stating my views and suggestions on some of the chief points involved in the subject I cannot but express my feeling of gratification at the liberal policy of the Government of His Highness the Maharaja of Mysore, with regard to the imparting of education to His Highness' subjects; and at the very able and exhaustive proposals for the improvement of education in Mysore presented by Mr. C. R. Reddy.

PRIMARY EDUCATION.

(i) The proposals for the future development of primary education and for the distribution of schools outlined in the memorandum, pages 3 to 7, seem to me to be in the main sound, and I generally agree.

(ii) The proposal for providing a school for every 600 population seems to be rather unsuitable for *malnad* tracts, where houses are situated far away from each other and the population thinner, whereas the same proportion for *maidan* tracts where opposite conditions are prevailing would be more than necessary. It would be more expedient to reduce the number for *malnad* parts say to 400 and raise it in *maidan* parts to 1,000.

(iii) Further, the primary grade schools should contain the 'Infant classes' and 'the three higher standards' as proposed by the Government and the aim of the teaching should be not only to make the pupils understand the 3 R's. so as to enable them to obtain a working knowledge of Kannada, but also to arouse and develop a spirit which is innate in children generally of enquiry into

and observation of everything that is around them in nature, so as to develop original ideas and thoughts which is very much hampered under the existing system of Primary Education.

COMPULSORY EDUCATION.

(i) The defects of the present compulsory education are very well brought out by Mr. C. R. Reddy. They are at once true and convincing. Some of those defects are irremediable and in a way it strikes me that instead of continuing such a system with its attendant defects it would be better to abolish the scheme altogether in view of the fact that the primary schools will be increased and facilities for education will be brought thereby nearer home to people.

(ii) Even after the proposed 10,000 primary schools are established and the Compulsory Scheme extended even to the rural areas, it will not be possible to bring each and every boy under the scheme and the defects pointed out by Mr. Reddy, will yet be existing.

(iii) Should it be considered as not expedient at this stage to do away with that system altogether, I think that there should be no independent school committees. But the Municipality should appoint special sub-committees for the control of the Compulsory Education. Unless Municipalities undertake financial responsibility for Compulsory Education, this cannot be done.

(iv) It is also necessary to raise the compulsory age to 12 at least, if not to 14, so as to bring within the scope of compulsory education also the literary and vocational instruction imparted in the Middle Schools so that the pupil may not relapse to illiteracy, as is the case hitherto in the generality of short course cases.

(v) Local bodies should be vested with larger control over village Elementary Schools.

(vi) The principle laid down on page 10 of the memorandum as regards distribution of Educational Finance between the District Board and the Government is sound and may be adopted.

SECONDARY EDUCATION.

MIDDLE SCHOOLS.

(i) There are now two distinct types of Middle Schools, *viz.*, Vernacular and Anglo-Vernacular Middle Schools. The former leads nowhere and as such should be abolished.

I am in favour of having only one type of Middle Schools where all instructions are given through the medium of Kannada, where education should proceed automatically from grade to grade and where both Kannada and English should be made compulsory, exception being granted only to such as desire to take a higher Oriental course or as do not wish to continue their studies in the High Schools or University.

(ii) The Middle School course must be lengthened in order to make it efficient. It should be one of four years following the III standard Vernacular, provision, however, being made for admitting deserving students to 2nd year class of the Middle School course if found qualified after leaving the primary schools so as to enable the industrious and well taken care of students to shorten the Middle School course by one year. English may commence in the Middle School course. English is unnecessary in the primary schools.

(iii) Science of a rudimentary nature, useful in every day life, and drawing should be taught in the middle schools.

(iv) The financial scheme outlined on page 13 of the memorandum for the increase and improvement of A. V. Schools may be adopted.

HIGH SCHOOL.

(i) In view of the waste of brain power and time and the imperfect assimilation of knowledge involved in the present system and also in view of the fact that the

end of Education is rather the development of the faculties than the power of expression in a foreign language, I am in favour of the introduction of the vernacular, that is (Kannada) as the medium of instruction in High Schools. If the vernacular, *viz.*, Kannada be the medium of instruction, it will also largely facilitate mass education and the education of women.

POLITECHNIC TYPE OF SCHOOLS.

(ii) The principles laid down on page 17 of the memorandum in order to introduce an efficient system of practical instruction seem to me to be very sound and may be adopted.

TECHNICAL EDUCATION.

(*iii*) The measures recommended on page 19 to improve industrial education in the State seem to be very sound and should be undertaken.

AGRICULTURAL EDUCATION.

(iv) As regards the agricultural instruction, the suggestions made on pages 20 and 21 of the memorandum may be given effect to fully.

COMMERCIAL EDUCATION.

(v) The curricula of commercial courses and examinations proposed by the sub-committee appointed to consider the subject may be adopted.

(vi) Industrial schools should be under the control of the Director of Industries and Commerce since their utility depends upon their connection with the general industrial requirements of the country and their working on commercial methods.

EDUCATION OF GIRLS AND WOMEN.

(i) The two outstanding questions in respect of women's education are medium of instruction and the revision of the curricula.

As regards the first arguments in favour of the vernacular, *i.e.*, Kannada medium apply with double force since the period of school life in the case of girls is very short.

As regards the second, subjects suited to the needs of women should be introduced. Subjects connected with the household management, maternal responsibility as also music, and drawing and painting should be given a permanent place in the curriculum, having regard to the peculiar customs and mode of life of Indian women.

(ii) The curriculum of subjects of girls up to the Lower Secondary Examination as drawn up in Appendix D is well adopted for their requirements. Beyond this there seems to be no necessity to differentiate between the courses of studies for girls and boys. There can be no made-easy for culture and learning and it would be impossible to infuse all the required knowledge to the girls in a shorter time than their brothers take to acquire the same. Miss. Rukminiamma's views on the subject seem to be quite acceptable.

As the memorandum rightly observes the more urgent question is the expansion of education among girls up to 12 years of age. The provision made for the increase of primary schools will, it is hoped, meet the requirements.

THE EDUCATION OF SPECIAL COMMUNITIES.

(i) *Mahomedan Education.*—There need be no separate organization for Mahomedan education. Mahomedan boys should learn Kannada as it is necessary for their advancement. Mahomedan boys may receive their education along with their Hindu brethern in the same primary and middle schools, special teachers being appointed to teach Urdu in these schools. This will widen their outlook and contribute to their progress, besides bringing the Hindus and Mahomedans together from their infancy and make their tie stronger for their commonweal.

(ii) *Education of Backward and Depressed Classes.*—The concessions offered, the scholarships instituted, and the various

measures adopted as outlined in paras 27 and 28, pages 27, 28 and 29 of the memorandum will go far towards encouraging education in these communities.

TRAINING INSTITUTIONS.

Considering the rapid expansion of education in the State, there is a great paucity in the number of trained teachers. Ways and means must be found for training 1,600 teachers per annum, the number arrived at, as necessary, in the memorandum.

ADULT EDUCATION.

The night schools require more adequate supervision and control. At present pupils make no progress. Under better inspection their efficiency may be increased.

DIRECT MORAL AND RELIGIOUS EDUCATION.

(i) This has hitherto been not productive of beneficial results. For want of competent teachers and suitable books the teaching has been soulless.

(ii) It is quite necessary to make the curriculum of religious and moral instructions an integral part of the course of studies. Compilation, or preparation of suitahle books if called for and encouraged would be easily forthcoming within a short time. So also the teachers.

(iii) The principles of Hindu Religion common to all the Hindus shonld be taught as a compulsory subject. Provision must be made for the teaching of the pupils of any particular persuasion, if sufficient number of students are forthcoming.

PUBLIC EXAMINATION.

A primary grade examination would be very welcome to standardise tbe teaching in the whole State, but it should not be a public examination nor should it put the students into any extra cost or strain.

SCALE OF PAY OF EDUCATIONAL OFFICERS.

While the pays of almost all the teachers, Head-masters and others are raised in a reasonable manner it is really very disappointing to read that the pay of the poor pandits, drawing-masters and gymnastic teachers should be left as it is. These persons contribute not a little to the successful training of the pupils in their charge while their over acquirements especially of the pandits are as valuable and useful as those of the graduates of universities. The salaries of the pandits must be raised to Rs. 100 in all High Schools and those of the others also suitably.

DEPARTMENTAL PUBLICATIONS.

While giving every encouragement for the publication of books in Kannada on technical subjects, the publication of books in Kannada language and literature seem to have been overlooked. Till some time ago 'Karnataka Kavya Kalanidhi' was enriching the Kannada language by publishing rare and excellent Kannada Works of old authors. Such a valuable journal has now ceased to exist, because as I learn the Government withdrew the snpport that was till now being given to it. Such journals shonld be given every support and suitable provision should be made to ensure the continuance of such invaluable publications.

CHANGE OF BOOKS.

The present system of frequently changing books in most of the subjects such as Mathematics, Grammer, Composition, History, Geography, Science, etc., both in Primary and Secondary courses, has the drastic effect of unsettling the acquisition of steady knowledge and a steady impression of ideas in the tender minds of the young students not to speak of the unnecessarily additional costs and worry to the poor students and their poor parents. There must be a standard text-book on each subject, one set for the Primary and another for the Secondary courses. These books ought not to be changed at all for at least eight to ten years. Any new change or improvement in these

subjects that may happen to come into existence by other publications must be studied by the teachers and taught to the students by means of notes on such subjects. By this method such wholesale changes as would necessitate of books themselves are not likely to occur for a number of years.

Similarly the recent change necessitating a multiplicity of uniform exercise books for all classes on all subjects, has become almost a daily concern, worry, and waste of money to poor parents and students without the corresponding advantage to them. This also must be curtailed in higher classes below the 2nd class whose exercises and examinations should be confined to slates only.

ANOTHER MATTER OF PUBLIC INTEREST.

I cannot refrain from alluding here to the great inconvenience felt on account of their honest religious objections in various parts of the State by certain sections of His Highness' subjects, by being obliged to withdraw their children from the Government Schools and in some cases from education itself wherein regardless of their long long standing honest religious sentiments panchama boys were admitted under a recent circular of the Inspector-General of Education.

This seems to me to be against the policy of all the good Government. In the new scheme it would be better to provide for separate schools for panchamas as hithertofore and thereby remove the cause of the present difficulty and the uncalled for hardship.

The panchamas may be educated separately in such a manner and for such a time as would enable them to help themselves and to have all the enlightened good ideas of life and living; so that they may be equally useful citizens as other classes of the public which is all the object of every good Government.

In conclusion, I add that the subjects of His Highness the Maharaja of Mysore will gratefully welcome the liberal proposals set forth in the memorandum for the spread of education in the State, and will co-operate with the Government in working out the same.

II.

Rev. A. R. FULLER, B.A. (Lond.).

Among the many interesting and important subjects referred to in the Memorandum on Education is the subject of the medium of instruction. So far as Primary and Middle Schools are concerned it is generally agreed that for all subjects except English and Arithmetic the vernacular is the most suitable medium of instruction.

There is, however, considerable difference of opinion as to whether this practice should be extended to the High School stage.

In *theory* it would seem more natural for education to be imparted in the mother-tongue of the student, and national *sentiment* might seem to favour such a course, but, as Mr. Abdur Rahim said in his Convocation Address, every care should be taken not to sacrifice the interests of sound education for the sake merely of sentiment, and if we consider the actual condition of things in India as a whole, and in Mysore in particular, it seems to me that there are a number of considerations which make it difficult and undesirable to make the vernacular the medium of instruction in Secondary Schools.

1. It has to be remembered that even such a comparatively small area as Mysore is not homogeneous so far as language is concerned. In Bangalore for example, Kannada, Tamil, Telugu, and Hindustani are all widely spoken, while in some parts of the State, Telugu or Hindustani is the prevailing vernacular. If, then, the vernacular is to be the medium of instruction, either schools for the different vernaculars will have to be opened, or numbers of students will still be unable to be taught in their mother-tongue unless they leave the State for their education.

2. But, in addition to difficulty with regard to pupils, there will be great difficulty in regard to *teachers*. At present, some of the best teachers are gentlemen from outside the State, or gentlemen from inside the State whose vernacular is not Kannada. Even as things are now there is great difficulty in getting a sufficient number of qualified teachers for existing schools, and, if the supply is to be limited to Kannada speaking men, the difficulty will be very greatly increased. It is futile to say that all such teachers must learn Kannada, for most of them will seek employment elsewhere, and even if not, what are schools to do while such teachers are learning Kannada, especially as such a contingency may arise whenever a new appointment is made?

3. It is very doubtful whether *public opinion* is in favour of making the vernacular the medium of instruction in High Schools. It may be said, by some, that public opinion is uninformed, and that the public do not know what is good for them, but I venture to think that it is wiser to inform public opinion and create a demand before introducing so radical a change. It is certain that, rightly or wrongly, many people think that the suggested change would be detrimental to the study of English. A good test of public opinion would be to introduce the change in certain High Schools only, give them as good a staff and equipment as possible, let them prepare students for the S.S.L.C. examination, and let the papers in that examination be set and answered in either the vernacular or English. I believe that most of the advocates of vernacular as the medium are averse to such a course as they fear that if the public are given a choice they would choose the English school.

4. Among other considerations which may be mentioned are the following:—The introduction of the vernacular as the medium of instruction in such subjects as Science, Histories, Economics, Commerce, etc., would lead to the prevalence of a very 'pigeon'-vernacular habit of speech much to be deprecated in the interests of the vernacular itself. Then again, it is very doubtful whether suitable text-books in the higher branches of study are procurable in the vernacular, and still more doubtful whether there are, or are likely to be, a sufficient number of satisfactory *books of reference* in the different subjects.

Personally, I think that the difficulty of learning through the medium of English is often greatly exaggerated, and certainly it is not true to say that India is the only country where pupils are being educated in a language other than their mother tongue. I believe that in America, and to a certain extent in Japan, there are numbers of pupils who are being educated in English rather than in their own mother tongue.

For all of these reasons, while I am in full sympathy with all movements that aim at the improvement of vernacular study, I think that it would be a retrograde step to make the vernacular the medium of instruction above the Lower Secondary standard.

It is interesting to read a brief para on fruit experiments in the Report on Agriculture in Assam during 1918—1919. The Report says:—The Fruit experiment station at Shillong has containued to make satisfactory progress. The total area of the garden is 62 acres, and out of about 30 acres, which are suitable for fruit growing, 28.75 acres have been planted. Good fruit, including numerous varieties of apples and pears, has been produced and about Rs. 900 worth of fruit was sold locally during the year. Arrangements are being made to have grafts supplied from the station for use in the Khasi and Jaintia Hills. The results are promising.

ECONOMICS IN THE WEST.

Orientation of Labour.

London, 20th November, 1919.—We are still slowly but we may hope surely emerging from the troubles of the War period. The signs of improvement are many. Trade is brisker, money is more plentiful, prices though not lower are more stable, and finally, and most important of all, Labour is more placable. We are warned by competent observers that there are still storms ahead, and I think that is the case. But we are more prepared than we were for industrial trouble and if it comes it will not hit us so badly as it has done in the past. Undoubtedly things are moving towards a new Orientation of Labour to adopt a familiar diplomatic phrase. The agreement just concluded with the Railwaymen's Union is most significant in this connection. In future the Railways of the country are to be under the control of a Board of ten formed as regards five of railway general managers and as regards the other five of delegates appointed by the Railwaymen's Union. This, it is almost needless to point out, is a revolutionary departure from the old system in which the companies were managed by Boards of directors with autocratic powers over their employes and it is a long way in advance even of the War system in which a Board of general managers assisted by Government officials controlled the railways. In fact, it is practically guild socialism, a system of Labour development supported by the extremest advocates of the rights of Labour. Under the guild system an industry is worked by guilds on behalf of the workers. The workers are in sole control and their interests are paramount. It is not difficult to see how oppressive such a system may be made to the general body of consumers who through enhancement of prices of necessary articles or services may virtually be made to support a monopoly run in the interests of the comparatively few. In the case of the railways it may be urged that the workers have only half control. That is true, but who imagines that they will stop at that in the case of an organization like the railways or of an industry like mining where outside competition is not a serious factor? For my own part I have very little doubt that we are moving rapidly towards that nationalisation of the means of production and distribution which is the goal of the socialist. It will be a tremendous leap in the dark and once the step is taken it will scarcely be possible to retrace it. A consoling thought is that long before the main issue of nationalisation has to be decided we shall have experience of the earlier experiments with the railways and mines to go upon. If there is a very bad record, as there may very well be, the nation will be able to set the principle. The question is one of such transcendent importance that I cannot imagine it possible that a final derision will be made until there has been an appeal to the country.

How selfish and monopolistic are the tendencies of modern Labour in this country is shown by the manner in which the Trade Unions are dealing with the question of female labour. During the war over a quarter of a million of women were employed in various industries some of them in positions of great responsibility and all working on lines usually followed by the ordinary male workers. Naturally it was assumed that these often highly self-sacrificing women when the war concluded would if they cared to remain at work be permanently employed. But those who expected this were reckoning without the exclusiveness of the Trade Unions. A report just issued by the Women's Industrial League which has been making inquiries on the subject shows that of the quarter million women originally employed only 79,000 were in the workshops

at the end of May last and that this number was rapidly dwindling because the Unions would not allow the women to be employed. One firm wrote as follows to the Society on the subject:

Since the armistice, the Amalgamated Society of Engineers has insisted upon our dismissing the women working on armature work, because we were not employing women in the same room or department as formerly. We don't think the decision was a fair one, and we make our protest accordingly, but without avail. We venture to express the opinion that women's work is infinitely better than men's for many branches of our work.

We are more than pleased with the loyalty, cheerfulness, and willing service of the women in our employ. They are unquestionably an example to the male labour, practically without exception.

We intend to keep women as long as allowed, for they have given complete satisfaction and are displacing no men.

It is hardly necessary to comment on the spirit here revealed of the mind of Labour as it is directed by the Trade Union leaders. The old mediæval Guilds usually cited as monumental examples of selfishness were not more narrow in their exclusiveness than the up-to-date Labour organizations are showing themselves to be. It is their tendency which excites the greatest apprehension for the future of British industry. For the full development of our resources free trade is just as necessary in the sphere of artisan employment as it is in the wider region of international competition. Under modern conditions what possible future can an industry have which is hedged round with a high wall over which no one can climb who has not first passed through the extremely fine sieve of the Trade Union's laws. There is the less excuse now for the barriers raised because all the world is crying out for British goods and manufacturers do not find it possible even to a limited extent to keep pace with the demands they receive. A striking example of the mischief wrought by the curious obtuseness of the Trade Unions to the needs of the time is supplied by the action of the Bradford wool-workers who for weeks resolutely declined either to do overwork or to permit the employment of female labour though the demand for the Trade's goods was never greater. When these things happen one is almost disposed to question whether the British worker will ever rise to the necessities of the present unexampled situation.

An Important Movement.

An important movement has just been inaugurated by the Royal Colonial Institute which if it is well supported, as it is almost certain to be, is likely to have a far reaching influence on the economical and industrial development of the Empire. The scheme in question aims at the placing of Colonial students who have finished their University course in large manufacturing works in this country to receive their technical training. There is, of course, nothing new in the reception of youths from the outer marches of the Empire in the leading factories and engineering establishments of Great Britain. One of my earliest recollections as a boy—now alas! more than a half century ago—was of meeting daily on my way to school a number of Indian students who were being instructed at the extensive works of a leading firm of railway engineers. But these isolated and spasmodic efforts were very different from the extensive and systematic introduction of students now contemplated. On both sides—in the Dominions as well as in Great Britain—influential aid is enlisted for the scheme and there is every reason to suppose that it will develop into a great organization of wide scope and potentiality. India is not embraced in the arrangement, but obviously she is deeply interested and ought not to be left out. Those concerned will be wise if they take the necessary steps to secure her inclusion.

Civil Aviation.

General Sykes's report on the future of Civil Aviation contains much interesting information relative to the development of aviation since the war. We read of the careful production of weather maps and aerial charts, of experimental aerial lighthouses and of the establishment of a system of wireless telegraphy by which aeroplanes may be in continuous touch with the aerodromes below. A striking set of figures

given in the report shows that the civil aviation system has been attended with a minimum of accidents since its introduction. Thus, though there were no fewer than 21,000 flights recorded, 52,000 passengers carried and a mileage of 303,000 flown there were only thirteen accidents and only two of these resulted fatally. General Sykes foreshadows the development of Civil Aviation on lines analagous to those of the mercantile marine so that in time of war the regular forces of the Crown could be speedily reinforced by a large body of highly efficient men. He does not anticipate that there will be any very great scope for the carriage of mails by aeroplane in Great Britain owing to the comparative shortness of the routes but for Continental and overseas purposes he looks for a great future for the flying arm. His final conclusions are concerned with the financial position of the industry. He points out that at present the industry cannot stand alone and he advocates a system of subsidies based on actual weight carried and miles flown in order that the difficult initial period may be successfully tided over.

Japan's action in accepting, with some reservations, the provisions of the International Labour Charter with reference to children has exerted a good deal of comment here. What will India do? People are asking. The question may be answered before these lines reach their destination, but it may be recorded that there is a confident expectation that India will have to come into line on this question if she is to act up to her duty. At the same time the wide differences in customs and domestic habits between the East and the West are a factor which cannot be ignored. Here a woman doing hard labourer's work is almost an object of pity. In India the female cooly is a common figure. Some of the points of divergence can doubtless be reconciled, but in the main it will probably be found in the long run in this as in other matters that "the East is East and the West is West." Where agreement will be possible and salutary will be in establishing a uniform system of protectors of the workers from accident and in establishing a uniform standard of treatment as regards housing and welfare.

ARNOLD WRIGHT.

INDUSTRIAL NOTES FROM THE UNITED STATES.

The Romance of the Telephone.

Washington, D.C., U.S.A., Oct. 28, 1919.—Alexander Graham Bell, the inventor of the telephone, who resides in Washington, says of himself that he is no business, and that he has no interest in the commercial side of an invention. But he was so fortunate as to have associated with him in the early days of the telephone men who were able executives and business men, and who not only made the telephone a commercial success equalled by but few enterprises in the world, but safeguarded the inventor's interests so that he, too, received benefits from the commercial side of his invention, he being to-day a man of large wealth.

To-day, in his seventy-third year, Dr. Bell is keenly interested in science and invention and is hard at work on many different problems, although no longer engaged in telepone research.

The genesis of the invention of the telephone is intensely interesting. Inventions or discoveries are all in one of two classes—they are either accidental or they are the direct result of experiment and investigation, trying to find a means to produce a result the possibility of which has first been admitted in the mind.

The telephone was of the latter class, as, indeed, many of the great inventions of the world have been, such as the air brake, sewing machine, electric light, cotton gin, reaper, etc.

The theoretical possibility of the electric transmission of sound over a wire was probably realized before Morse demonstrated that signals could be sent. But to recognize that a thing is possible is one thing—to do it is quite another. Thus Langley knew that mechanical flight was possible—he even

accomplished it with a small model (and by the way that historic first flight of a heavier-than-air machine on the Potomac River just below Washington was both witnessed and photographed by Dr. Bell, who has ever since been intensely interested in aeronautics and has himself contributed largely to its advancement). But Langley did not know how to get his machine into the air. Reis had experimented with a make-and-break current in the mistaken idea that the voice could be thus reproduced. *Sound* can be so reproduced, but not *speech*, as we now know. Dr. Bell conceived the idea that if an undulatory current could be produced, which was continuous, not intermittent, which would follow in its fluctuations the fluctuations of the human voice, it might reproduce that human voice at the other end of the wire.

At the same time he was experimenting in a field which all his life has been that nearest his heart: the aid and instruction of the deaf and dumb. He was endeavoring to produce, by transcriptions of the human voice through a vibrating diaphragm and needle, a record which could be read visually by the deaf. But a comparison of such records, made on smoked glass, with the formations of the manometric flame, under the influence of the voice, showed him that his apparatus must be far more delicate and responsive if it was to be accurate. So he visited one of the country's leading surgeons, and asked him to teach him more about the human ear that he might make a diaphragm as small, as sensitive and as accurate as the ear-drum.

"Why not use a real ear?" suggested the surgeon.

"Get me one," was Dr. Bell's answer.

"So he got me one." Dr. Bell tells the story with much interest. "He got me a human ear and cleaned it up nicely. I attached my little bristle to one of the small bones, made an ear shell, and there I would sit for hours and hours at a time shouting into that dead subject's ear, getting records. Then it occurred to me one day to wonder at the fact that the tiny little drum could move the relatively heavy bones of the ear as it did. And if an ear-drum could move a bone a great many times its own weight why couldn't a diaphragm membrane move a relatively heavy piece of iron? Right there the idea of the telephone was born. And there I was, at work again at my other line of work, and the sensitive diaphragm with the little piece of soft iron vibrating in front of a magnet was the result—and the principle of the telephone was established. About ten months later I eliminated the battery and substituted an all-iron diaphragm for my membrane with an iron center, but the principle remains the same to-day—the undulatory current which reproduced similar vibrations in a similar apparatus at the end of a wire."

The writer often talks with Dr. Bell in his secluded office in the American Security and Trust Co. here, of which organization his son, Charles J. Bell, is the president. Dr. Bell knows a thousand stories of the telephone in its early days. "You ask for telephone stories. I will tell you one," he said to me. "You know, of course, that the telephone is used in surgery, in connection with locating foreign bodies in the body? Well, last summer our government lost a whole boatload of iron in the ocean near Nova Scotia. Boat upset. And, of course, there wasn't any way of marking just where it went down. So I hung a brass bar at the end of a telephone wire, connected it up, and dragged for the lost cargo. And in a short time we located it with my submarine telephone surgical probe. I think it was quite fitting that the inventor of the telephone should use it that way. In a short time I have planned to try to locate a wrecked iron ship the location of which no one knows, and it will be located in the same way, of course."

Thus the telephone story—a single patent forty-three years ago—a world-girdling system

of wire and instruments to-day! Over eight thousand patents registered in the United States patent office, all connected with the telephone, *with billions in money created on* the industry they created—and the one man responsible for it all using his own invention to find a lost cargo, and much of the money he has made out of his brains to investigate other problems—boats, aircraft, longevity, helping the deaf and dumb.

Using the telephone is as commonplace as breathing. But *give the magic of the* growth of the industry which sprang from one small patent a thought the next time you lift the receiver and call for a number.

Waste Product of Rice Now Used in Sugar Refining.

In *the sugar refining process of to-day* raw sugar is put through large cylinders filled with bone black. The latter consists of pure carbon, suspended upon an infinitesimally thin skeleton of lime phosphates. The sugar after passing through the cylinders is found to have been bleached white, all the coloring matter having been retained by the carbon of the bone black.

In the effort to make it possible for the southern United States sugar planter to do his own refining, under his own sugar house roof, experimenters have tried out a great number of vegetable substances, endeavoring to char them into the carbon state and at the same time give them the necessary *mineral back-bone, analogus to the phosphates* of the bone black.

As a final result of such experimentation such a carboniferous substance has been presented to several of the state experiment stations, were thoroughly tested, and have been found eminently satisfactory. It had as its striking note a high content of silica, and *it was found to decolorize the sugar more* rapidly and more powerfully than did the bone black with its lime basis.

This silicious character suggested strongly that rice hulls would serve the same purpose, since they, too, consist largely of silica. They were tried and have been found so satisfactory that the discovery has been *submitted to the United States Department* of Agriculture, in Washington, with the understanding that the state chemists are willing to have their remarkable discovery made public property and available for use everywhere.

Heretofore the very decolorizing properties of the rice hulls have prevented their use *as feed for cattle, so that they have been* an absolute waste. The interesting proposition of using them as a sugar bleach will at once eliminate this waste and relieve the sugar planter of a heavy item of expense.

The method of preparation is simplicity itself. The leaves and hulls are separated *from* the straw, charred, and boiled in a five to ten per cent solution of caustic soda, and that is all there is to it.

Use of Lime in Agriculture.

From a United States Department of Agriculture summary of recent experiments in the use of lime in farming processes, conducted at a number of experiment stations, the following facts may be selected as noteworthy: At one station during a long series of years it was found that the use of burnt lime gave no crop increase, while pulverized limestone showed a crop-producing value of $1·20 per ton of limestone used. No evidence was found that caustic lime causes the loss of soil nitrogen by the destruction of organic matter to any serious extent.

Another station has, during the past twenty years, couducted experiments on the effects of lime on 280 different varieties of flowers, trees, small fruits, grasses, clovers and miscellaneous crops.

Lime is used to neutralize excess acid in the soil, as well as to increase the available calcium plant food. These experiments show that the difference in the residual effect on soil acidity of sulphate of ammonia

and nitrate of soda is quite marked. Among the plants found most sensitive to soil acidity are asparagus, barley, beets, celery, leek, lettuce, onions, clover, spinach and tobacco.

At another station the lime requirements of the soil were found to amouut to from 3½ to 5 tons per acre. After the acidity of the soil has been neutralized, the addition of a ton or two of limestone per acre every five years appears to be sufficient, according to the experiments.

FIGHTING THE PINK BOLL WORM.

In addition to its warfare on the cotton boll weevil, whose destructive operations cost the United States over $60,000,000 annual damage to its cotton crops, the country is waging a hard fight against the imported pink boll worm. The following interesting process for the destruction of the pink boll worm and other insect pests in the great Bush Terminal in New York City. Similar plants are also installed in Boston, San Francisco and New Orleans.

The cotton fumigation equipment at the Bush Terminal consists of a large fumigating chamber built of stout steel and provided with electrically-operated gas-tight-fitting doors at either end; a gas generator, and an electrically-driven vacuum pump. Tracks lead from platforms at either end of the fumigating chamber, right into the chamber, and two long cars are placed on these tracks for the handling of the cotton bales. In practice, one car loaded with cotton is pushed into the tank and left under treatment for the prescribed one hour and forty-five minutes, after which the other car, which has meanwhile been loaded, is pushed into the fumigating chamber from the other side. In this manner the equipment is never idle awaiting the loading and unloading of the cars.

After the cotton in its packed form has been placed on one of the flat cars and wheeled into the chamber, the two short lengths of connecting rails are removed and the huge steel door is electrically lowered into place, so as to seal the chamber. The air is now exhausted until the gage registers 25 inches. At this stage the gas is generated by introducing into the generator the following in the order named: Water, diluted sulphuric acid and cyanide in solution. The valve separating the generator and fumigation chamber is then opened either before or as soon as the cyanide solution begins to flow into the generator. The cyanide solution is then run in at such a rate that it will require from 8 to 10 minutes for all of the solution to be introduced. At the expiration of fifteen minutes air is permitted to pass through the generator for five minutes, to wash out all of the gas in the generator, and then the valve separating the fumigation chamber from the generator is closed. At this stage the air valve on the fumigation chamber is opened and the air allowed to rush in until the gage on the fumigation chamber falls to five inches. The bales are held in the presence of the gas and air for one hour and twenty-five minutes additional completing the required exposure of one hour and forty-five minutes.

At the completion of the exposure, to remove the mixture of gas and air from the cotton, the fumigation chamber is pumped to a vacuum of 25 inches, and on reaching this vacuum the valves of the chamber are opened. As the air enters the pump is kept running a sufficient length of time to remove an amount of air twice the volume of the chamber. The pump is then temporarily stopped, until the doors are opened, and then started again and kept running while the fumigated bales are being removed.

After the desired end gate has been raised, the workmen replace the two short lengths of connecting rail, and the flat car is rolled out. Meanwhile, the gate at the other end is raised and the other flat car, loaded with a new lot of cotton for treatment, is wheeled into the chamber.

The men, and particularly the one who lays the connecting rails in place, usually wear respirators which contain a sponge moistened with a one per cent solution of sodium hydroxide, as a protection against the poisonous hydrosyanic acid gas. Other precautions, such as blowers, are resorted to, and certain antidotes are always near at hand for emergencies.

REDUCING AMERICA'S FIRE LOSSES.

Apart from the thousands of lives destroyed by fire, the United States sustaines an annual loss from this cause of nearly $300,000,000—a per capita loss nearly ten times as great as that found in the leading countries of Europe.

In the great public movement to reduce this loss, led by the National Fire Protective Association, the United States Bureau of Standards is being most usefully employed in the determination of fundamental engineering data, to serve as a basis for the revision of state and municipal building codes. It is now proposed by the bureau to continue the fire tests already begun on structural steel building columns, fire-proofed in different ways, and of reinforced concrete columns of different aggregates and types of construction. Tests of floors, roofs, fire-resisting doors, shutters, windows, etc., will eventually be included in the program in order to supply American engineers with the data necessary for re-drafting the present codes. The bureau is now having built a "fire hut" 50+25 feet, for special experiments on the standardization of fire tests. This would provide means for observing the temperatures attained in characteristic types of fires in such a structure when furnished, for example, as an office, a furniture storage warehouse, a unit of a department store, etc.

ALFRED T. MARKS.

NOTES.

The Madras Fisheries Department has for some time been running a factory for canning sardines and other fish at Beypore In Malabar. The factory has hitherto been under the direct charge of a lowpaid subordinate officer whose operations were supervised and directed by Sir Frederick Nicholson. Sir Frederick Nicholson's other duties did not permit him to give to the officer in charge of the factory as much supervision and advice as was necessary, and in 1918 he drew attention to the fact that the appointment of an expert manager was advisable. Mr. Hornell, the Director of Fisheries, who inspected the factory this year before taking charge of it from Sir Frederick Nicholson, agreed in considering the appointment of a well-paid whole time business manager necessary. He pointed out that the tannery has now passed the experimental stage and that the comparatively slow progress made in recent years had been largely due to the lack of a capable wholetime business manager continuously on the spot. He, therefore, suggested that Government should either sell the Beypore factory or develop it to its fullest capacity by the appointment of an energetic business manager on a good salary with a substantial interest in the profits of the factory. Government decided that the Beypore cannery should not be sold at present, drew the attention of the Director to the desirability of using it for training expert artizans and managers who might be available for employment in other factories hereafter to be established by private firms and requested him to submit, in consultation with Sir Fredrick Nicholson, detailed proposals for the further development of the Beypore cannery. The Director has since reported that the first need of the cannery is the appointment of an energetic manager with some business experience and an interest in

the profits of the cannery. The expert knowledge required for the cannery business is said to be small, and the Director of Fisheries expects to be able to spare time to impart the necessary technical knowledge to the manager. Sir Frederick Nicholson is in general agreement with this view. There is, however, some doubt as to the suitability of Beypore as a location for the cannery. The Government have now been pleased to appoint Mr. H. L. Prager, Inspector, Second grade, in the Salt and Abkari Department, for a period of two years to manage the cannery at Beypore. Mr. Prager will be paid a salary of Rs. 70 per mensem. He will also receive as a bonus a percentage hereafter to be fixed by the Government of the profits earned yearly over and above the average profits of the two years ending with 30th June, 1919. The accounts of the cannery will be audited annually by a firm of chartered accountants. The question of transferring the cannery to a more favourable locality will be considered after the results of the new arrangements have been watched. The Director of Fisheries has also been requested to submit a detailed scheme for the admission of apprentices for practical instruction in cannery methods and for the opening of small experimental canneries at selected centres in the Presidency.

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The Season and Crop Report of the Madras Presidency for the Agricultural year 1918-19 has been published and can be obtained from the Office of the Superintendent, Government Press, Mount Road, Madras, for a price of 12 annas. This report contains very interesting statistics. The first statement shows for each district the rainfall for the year and the average rainfall. The next statement shows for each district the area cultivated, the area under forests, the area not available for cultivation, the area of culturable waste and the area left fallow. It also gives particulars of the area and the crops irrigated. The next statement compares for each district the area cultivated in a normal year with the area cultivated in 1918-19. The third statement shows for each district by what percentage the outturn of each crop exceeded or fell short of the normal. The fourth statement shows in tons the estimated yield of the more important crops in each district. This estimated yield is compared with the estimate for the previous year and with the normal year. The fifth statement shows the harvest prices of the principal food grains in the different districts and compares these prices with the prices obtaining in the previous year and with the normal prices. The sixth and last statement shows the number of the cattle ploughs and carts in each district according to the Census made in 1914-15. In the ryotwari tracts of the Presidency, Cultivation accounts are maintained for each field by the village Karnam and are checked by supervising officers. A fairly high standard of accuracy can, therefore, be claimed for the figures given for the area cultivated with different crops and for the area irrigated. The estimates of total outturn are, of course, less trustworthy as the difficulty of estimating the outturn is great; special attention has, however, been paid to the point in the last few years, the estimates are undoubtedly more reliable than they were, and it is hoped that every year will see a nearer approach to accuracy. The cattle census is very difficult to take and too much reliance should not be placed on the figures. But the report as a whole is likely to be of use to all students of the economic condition of the country and to the merchant community.

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In the course of their review of the progress report of Forest Administration in the Punjab for the year ending 30th of June, 1919, the local Government state:—At the Jallo Foctory, 28,778 maunds of resin were distilled compared with 16,426 in the previous year. Excluding 2,632 maunds distilled for the United Provinces, the yield of

rosin was 18,734 maunds and of turpentine 52,701 gallons. The average sale price of rosin was Rs. 17-8-3 per maund compared with Rs. 16-3-4 in 1917-18. The system now adopted for the marketing of Jallo Factory rosin and turpentine, which has taken some time to perfect, consists in the fortnightly fixing of prices on information received from agents at the chief ports, the basis of the price being the import rates of American rosin and turpentine, which are undersold. This system, in which the United Provinces' factory co-operates, has worked so far without a hitch. A geographical distribution of sale areas, including within its scope the export trade, between the Jallow Distillery and the Bhowali Distillery of the United Provinces, has also been introduced, and an agreement exists between the two factories under which each can borrow the products of the other in case of need. This organization of sales is realizing excellent results, and there is reason to believe that the home product is rapidly supplanting American imports. Attention is also being paid to the standardization of rosin and turpentine while research has opened new prospects for the production of rosin oil, a commodity for which a considerable commercial demand is reported to be probable. The net profits of the resin industry rose from Rs. 2,11,562 to Rs. 2,41,177 and the rate of interest earned on the invested capital from 210 per cent to 232 per cent. These are remarkable results from an enterprise which was restarted on modern lines as recently as 1915. A second Ropar's unit has now been ordered for the Jollo Factory and the prospects not only of supplying the Indian demand but also of building up a sound export business in the future are exceedingly bright.

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The following particulars relative to hydro-electric developments in Japan, furnished by His Majesty's Commercial Secretary at Yokohama, are published in the *Board of Trade Journal*:—The newly-formed Japan Hydro-Electric Company, which has a capital of yen 50,000,000, proposes to work the most profitable of the water-power rights furnished to it and hitherto held by three companies in certain prefectures and other districts. The new company proposes to generate 1,05,000 kilowatts, and the work is to be completed in the course of two full years. Local demands will be met with part of the power developed, and the rest of the power will be transmitted to another district. The two electric light companies of Osaka and Kyoto have agreed to take all the electric power required by them to meet the demand of the extensive districts over which they operate, so that there will be no difficulty whatever about the disposal of the electric power generated. Eventually it is believed that the company will be in a position to dispose of electric power up to at least 300,000 kilowatts easily and profitably. Another company, amalgamated with the new company on its formation, possesses a hydro-electric power-house capable of generating 7,200 kilowatts and carries on the manufacture of sulphate of ammonia. The latter promises to be a highly profitable business. The present scheme aims at supplying local industries with abundant motive power cheaply, and also at establishing a connection between the business of companies having common interests. It is interesting to note that coal costs fully five times in Japan as much as it did before the war; and that in consequence the cost of the production of electric power by steam has also been multiplied by five or even more.

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The Report of H. M. Senior Trade Commissioner (Mr. Thomas M. Ainscough, O. B. E.) on the "Conditions and Prospects of British Trade in India at the close of the War" (Cmd. 442, price 2s.), has just been issued. The Report is divided into five sections. Part I is a general survey of the present trade position and a study of the

most important factors which have contributed to it. An account is given of the effects of the elimination of the Central Powers, the entry of American and Japanese competition, the development of indigenous industries, and the considerable rise in exchange, all of which are direct results of the war. Part II is a detailed examination of the leading import trades, with special reference to changes in the character, volume, and origin of the imports during the years of war. Part III includes a review of the methods of representation and distribution in India and also definite recommendations as to the revised measures which might, with advantage, be adopted by British interests in order to meet the new conditions. Part IV treats of the development of Indian industries and its signifi cance, with special reference, firstly, to the opportunities for the employment of British capital and industrial management in the country, and, secondly, to the re-adjustments which will probably be necessary in some of tour export trades as a result of the competition of local industries. Part V consists of an account of the prospects for the sale of Canadian produce and manufactures in India. A map accompanies the Report, showing the Indian railway systems and the industrial and distributing centres.

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The Industries Section of the U. P. Board of Industries met at Cawnpore on the 25th November, 1919. Certain applications from firms for loans from Government were considered. In regard to those the Board hold that Government should ordinarily make loans only in the case of pioneers, and even then, only if the applicant had tried but failed to obtain the loan from other sources. It accordingly refused these applications but desired the Director of Industries to assist the applicants so far as possible in securing loans from a bank. A proposal to establish a tanning school was examined but it was decided that though the establishment of such a school was desirable the present proposal required modification. A proposal to purchase a silk finishing plant for the Central Weaving Institute at Benares then came before the Board but was not approved. Finally communications from Government dealing with various subjects were read and recorded. Of these the most important were :—1. A Government Order intimating that the recruitment of a Glass expert had been aproved for inclusion in the schedule of new expenditure of the year 1920-1921. 2. A Government Order sanctioning the appointment of Dr. E. R. Watson as Principal of the proposed Research Institute at Cawnpore, subject to confirmation by the Government of India. 3. A Government Order sanctioning rules framed by the Board regarding the award of scholarships for apprentices who desire to be trained at oil mills in India.

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The State of Patiala in the Punjab appears to have made speedy progress both as regards revenue and industrial development of recent years. From nearly 82 lakhs in 1912 the gross revenue of the State has gone up to over and 17 lakhs, and its ruler the Maharaja, who but recently returned to India after strenuous and praiseworthy work at the Peace Conference, has under consideration industrial, commercial and agricultural programmes. A State bank was opened last year and is now doing useful work. A hydro-electric scheme for the State, which was referred to the Punjab Government in April last, has since been considerably expended. Under tbis scheme it is intended to harness the Sutlej river some 16 miles above the proposed dam at Bhakara and by constructing a series of falls to generate electricity which, it is estimated, will give 1,35,000 horse-power. This power will be transmitted all over Patiala and used for lift irrigation by means of tube well to irrigate an additional area of about 6¼ lakhs of acres as also for supplying motor power to various existing and contemplated industries. The climate and soil of Patiala are particularly

conducive to the development of different kinds of industries, and an industrial survey is being carried on with a view to tap and develop its forest and mineral resources. The development of agriculture and urban co-operative credit societies is receiving special attention, and a big railway programme is also under consideration.

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The impetus given to the Canadian chemical industry, due to exceptional demands during the war, is shown in a report issued by the Dominion Bureau of Statistics. This report contains a directory of Canadian chemical industries, with names, addresses, and products of firms whose products are either chemicals or are the result of processes involving chemical change. The number of plants operated is given as 634, 161 of which are situated in the Province of Quebec. The out-standnig progress made during the war was probably the construction of the world's largest glacial acetic acid plant at Shawinigan, Quebec. An entirely new process beginning with acetylene was developed, while acetone, paraldehyde, crotonaldehyde, mercuric oxide, and manganese acetate are now also produced, and magnesium of purity ranging from 99 per cent to 99·9 per cent is made electrolytically from its fusel salts. The following figures show the increase in valve of exports of Canadian drugs, dyes, and chemicals during the fiscal years 31st March, 1912-1919:—1912, 1,677,216 dols.; 1913, 1,800,437 dols; 1914, 1,730,203 dols; 1915, 3,543,701 dols; 1916, 6,449,145 dols; 1917, 9,218,415 dols; 1918, 14,207,609 dols; 1919, 17,053,074 dols, The imports for consumption of drugs, dyes, and chemicals into Canada in the last fiscal year amounted to 32,783,704 dols., of which 23,785,191 dols., represents the value of chemical products imported from foreign countries, and 4,003,513 dols. the value of such products imported from British markets.

The important question of the future of wheat production, with special reference to the Empire, is dealt with at length in the current number of the *Bulletin of the Imperial Institute.* The annual production of wheat in the world prior to the war amounted to about 110,000,000 tons, the largest producers being the Russian Empire, with an output of 22,000,000 tons and the United States, which provided nearly 19,000,000 tons. During the war the production in Europe as a whole, and in Russia in particular, decreased considerably, but outside Europe there was a great expansion. The acreage under wheat in Canada, the United States, Argentina, India and Australia in 1918 was over 25 per cent larger than the average acreage for the five years before the war and it is considered that, at the present time, there is a sufficiency of wheat, even without the help of Russia, to meet the requirements of he world. As regards the future also there is reason for optimism. There are vast areas of land suitable for wheat growing yet to be opened up in Canada, Australia, South America, Siberia and other countries, whilst the present low average yield of 13 bushels per acre is susceptible of great improvement. In recent years the increase in the world's production has been due, to a great extent, to an increased yield per acre, and there is every reason to believe that with the introduction of improved drought and rust-resistant varieties the rise will be even more rapid in the future.

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The *Board of Trade Journal* (November 20th) reviews the conclusions arrived at by a special committee, after touring the Dominion to ascertain the immediate possibilities of New Zealand's secondary industries. The Committee propose the establishment of a Board of Industries and Commerce and a Board of Science and Industry. The former, consisting of three members of wide business experience, would be empowered *inter alia* to engage in trade, investigate and control

prices, prevent exploitation of the public and suppress profiteering, make advances to industrial and commercial concerns, and prevent unfair methods of competition. The Board would also be charged with the duty of investigating such matters as the encouragement, improvement, and extension of New Zealand industries and manufactures; markets outside the Dominion and the opening up of external trade generally; wages and social and industrial conditions; labour, employment, and unemployment. One of the chief functions of the other Board would be the consideration of all proposals for specific scientific researches. It would be able to create scholarships and to award bonuses and prizes "with the object of encouraging scientific and industrial research." Apparently New Zealand is the only Oversea dominion in which an organization for research has not been provided since August, 1914.

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A meeting of the International Federation of Cotton Spinners and Manufacturers was held in Paris early in September. It was decided to continue to collect and distribute international statistics relative to cotton and its consumption. In view of the World Conference, which is to take place in New Orleans next week, the International Federation decided to be officially represented, and Sir Herbert Dixon (the President), Signor Nylino (Treasurer), and Mr. Pearse (Secretary) were designated to take part in the Conference. Interesting reports were communicated by representatives of the different countries relative to the effects brought about by the new hours of work on the position of the cotton industry. A resolution on the necessity for the extension of cotton-growing regions was adopted. The International Committee also adopted the essential recommendations contained in the recently published report of the Indian Cotton Commission. The Secretary was instructed to take immediate measures for distributing to affiliated organizations a report on Indian Cotton, the report being a résumé of investigations carried out in India before the war on the question of the cultivation of cotton. It is probable that the next International Congress will take place in Switzerland in the summer of 1920.

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The administration report of the Mysore State for the past year contains an interesting record of the financial results of the Cauvery Power Scheme. The total quantity of power generated at Sivasamudram during the year was 10,25,30,000 units as against 9,10,87,900 units in the previous year. Of the power generated 88,89,54,080 units were supplied to mining companies in Kolar Gold Field, 99,66,520 units to Bangalore and 36,09,400 units to Mysore City. As regards financial results, the aggregate outlay on the Cauvery Power Scheme up to the end of the year was Rs. 1,20,49,811. Gross earnings from the scheme amounted to Rs, 3,25,22,513 of which the sum of Rs. 10,56,323 represented interest charged at four per cent on the depreciation fund deposited with the government deducting from these gross earnings a sum of Rs. 1,63,50,913 of which Rs. 1,06,16,178 represented working expenses including depreciation fund set apart and Rs. 57,34,735, the interest at four per cent on capital outlay the net profit realised from the scheme for the past 17 years was Rs. 1,61,71,600, or an average of Rs. 9,51,270 per year. Deducting again from the net profit Rs. 11,45,360 the share of the revenue transferred to the Krishnarajasagara works from the 16th July, 1916, net surplus was Rs. 1,50,26,240.

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The fifth National Exposition of Chemical Industries was held at Chicago in the last week of September. The exhibition, which brought together about four hundred distinct exhibitors, attracted considerable interest to the chemical trade in general, and to other allied industries, both in this country

and in Canada, and brought together a very large attendance during the week. Foremost amongst the exhibits, both in interest and number, were those devoted to the chemical and dye industry. Another interesting exhibit was that of certain optical glass companies. In addition to this there were numerous exhibits of laboratory supplies, machinery parts and new commercial products produced from chemicals. An array of exhibits of chemicals for all purposes from different chemical manufacturing concerns were much in evidence. A Canadian electro-products company received a great deal of attention. The Department of Mines of the Dominion of Canada were also represented, with an agent on hand to furnish information regarding the mineral resources of the Dominion. The Ontario Bureau of Mines of Toronto, Canada, had a similar exhibit offering the same facilities.

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According to the Silk Association of America, scarcity of labour is the most serious condition which the silk manufacturer in the United States has to consider. Immigration has been the chief source of supply of this kind of labour, but there has been no immigration since the war, and many foreigners are returning to their native lands, having saved enough from their "inflated war earnings," to enable them to establish themselves in comfort in their own countries. This condition also causes a shortage in semi-skilled and manual labour, where wages are triple those earned in former years. Silk operatives who became munition workers have attained a certain degree of knowledge and skill in the metal trades, and many are remaining in those industries. Female labour has grown "alarmingly scarce." With wages advanced in all industries, the wives and daughters of families do not find it as necessary to seek work, and the children are being kept at school longer. It would be interesting to know if, for similar reasons, children of the more highly-paid workers in this country are being kept at school longer.

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The Director of Agriculture, Madras, reports as follows:—The area sown with paddy in the Madras Presidency up to the end of November, 1919, is estimated at 10,522,000 acres. In the previous year the area was only 8,347,000 acres. Thus there is an increase in area of 26 per cent for the whole of the Presidency. In every district, except Guntur, there is a greater or less increase in the area under this crop this year. This is due largely to the favourable season. Further the ryots have this year grown paddy on many lands under small tanks where cotton and groundnut had been cultivated in the previous years. It is gratifying also to learn that the average yield per acre will be above the average. It is at present estimated as being 9 per cent above the average crop. There was a certain amount of damage from heavy rains just before harvest in the deltas and the Circars. This may somewhat reduce the average yield. But in Ganjam, Kurnool, Nellore, Coimbatore, Trichinopoly and Tanjore the crops are reported to be considerably better than the average, while on the West Coast the crop is reported to be absolutely bumper.

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A Bombay Government resolution reviewing the work of the Registrar of Co-operative Societies for the year 1918, points out that the failure of the monsoon in 1918 severely tried the resisting capacity of agriculturists, who form the bulk of the members of the co-operative societies. The working of these societies shows that agricultural co-operation has achieved a high degree of protection against the vicissitudes of the season, and lends further support to the views of the government, formed as a result of the famine relief operations, that the people of the Bombay Presidency have developed staying power of unexpected strength, which was evidenced in the loyalty of depositors to their

societies as indicated by the comparatively small amount of withdrawals. In Bombay there is one agricultural society for 12,293 of the population and the average membership is 71 per society, while Madras and the Punjab have only 59 and 32 respectively. The average capital per society is also greatest in Bombay. Amongst the millhands of Bombay good work is being done mainly through the agency of the Debt Redemption Committee and Social Service League.

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Mr. W. A. Appleton, in his report on the Washington Labour Conference, says :— " I found some delegates who believed that the nations would officially accept the findings, but none outside the Conference who believed that international uniformity could result. Racial characteristics, climatic conditions and physiographic opportunities differ too widely for uniformity in hours, wages and methods to be possible. What may result is an arrangement by which the exhaustive effects of work may be ascertained and the real value of work determined. Generally it was agreed that humanity demanded the abolition of conditions which destroy health and happiness, but that the world is so short of necessaries that it cannot continue the support of the idle. Each nation, the Conference thinks, may be expected to guard zealously its right to work out its own salvation in accordance with its national circumstances and opportunities. Attempts to infringe this right may provoke internationnl quarries of far greater seriousness than those which arise from our own demarcation squabbles.

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The Madras Government is interesting itself in the development of fruit culture on the Nilgiris. The other day it accepted certain proposals for the establishment of a jam and pickle factory at the well-known hill station on the Nilgiris, Coonoor. By an order it has just passed that beautiful property, the government gardens and parks have been transferred to the Agricultural Department, the Curator being absorbed in the cadre of the department. It is proposed to entrust him with the work of studying the possibilities of fruit culture, and, in addition to improve the cultivation of the potato, of which there is an excellent variety grown on the Niligiri hills. The Madras Government has a most creditable record of useful enterprise in several directions. Thus, many years ago, it successfully pioneered the aluminium and the chrome tanning industries; and later, as has more than once been pointed out under the able guidance of Sir F. A. Nicholson, it organized the fishery industry, one of the most successful State enterprises in India.

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Two new sugar companies have been established in Formosa, both of which will carry on their operations in Shinchiku Prefecture. Hitherto sugar-cane has not been very extensively planted in this district, as it is rather far to the north, and the climate is not so well suited to the cultivation of the cane as that of the south. The present prosperity in the sugar market is, however, causing fresh land to be developed, and it is thought that the extreme fertility of the soil in the Shinchiku district may counterbalance climatic disadvantages. The Asahi Seito Kabushiki Kaisha (Asahi Sugar Manufacturing Company, Ltd.) has been established with a capital of yen 3,500,000, divided into 70,000 shares of yen 50 each. The promoters will retain 64,000 shares for themselves, the remaining 6,000 being offered at a premium for public subscription. The well-known Suzuki firm of Kobe are the moving spirits in this enterprise, the new company taking over the firm's interest in the district with a view to the erection of a modern sugar mill and the extension of operations.

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According to the "Osaka Mainichi," orders from Japan for British or American machinery are very large at present. The demand

is said to be concentrated on machinery pertaining to electricity, electric light and electric trams, steam boilers and spinning machinery. As regards the increase in the demand for electrical machinery, it is due to the development of communications and industry and also to the large increase in the price of coal. On the other hand, many capitalists who intended to import machinery for the enlargement of their business during the war, but hesitated on account of the enormous rise in the price of iron, have now made up their mind to import, as they have realized that prices will not decrease for some time to come, in view of the present labour and other difficulties prevailing in Europe. This attitude on their part has naturally increased the orders for foreign machinery, which have already amounted to large figures.

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A Press *communique*, says:—It is published for general information that it is proposed to hold a British Empire Exhibition in London in the summer of 1921. The primary object of the Exhibition is to promote the extension of Imperial trade by bringing before buyers from all parts of the world exhibits of the industries, inventions, raw materials and products of the Empire. The British Board of Trade has expressed approval of the proposal, and although the Government of India do not propose to participate officially in obtaining representative exhibits of all products, industries and raw materials of India, they desire to commend the Exhibition to the general public and manufacturing firms, and hope to arrange for a display of Indian timber. All requests for information should be addressed to the Director, British Empire Exhibition, 25, Ironmonger Lane, London, E.C.

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It is notified for general information that the Government of India have prohibited the export of Russian rouble notes to all destinations from and after the 17th January, 1920, except in the case of rouble notes deposited in a Government Treasury under the terms of the Rouble Note Ordinance of 1919 which may be withdrawn for export under a licence issued by a District Magistrate or Commissioner of Police. Any person obtaining a licence to withdraw notes already deposited by him in a Currency Office or Government Treasury will be permitted to retain them with a view to export for a period not exceeding ten days. In order to export them he should present his licence with the notes for export either to the Customs Officer or to the Post Office according to the means of export which he desires to use.

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Sheep farming continues to make but slow progress in Japan. Notwithstanding measures to secure home-grown wool, and the establishment of a scheme which was planned to be fully matured in a little more than ten years' time the number of sheep in Japan had increased from about 3,500 at the end of 1917, to only 6,000 at the close of the first half of 1919. As one aim is to increase sheep rearing to 1,000,000 head in twenty years, after which further efforts are to be made until the number reaches 7,000,000 it will be realised that very little has as yet been done towards rendering Japan self-supporting in the matter of wool supply.

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The Government Entomologist of the Agricultural College, Coimbatore, notifies that he is in a position to supply Fish Oil Rosin Soap at the rate of Rs. 0-2-1 per lb. This should be used to spray mango trees to save them from the mango hopper disease. A pamphlet containing iustructions showing how the soap should be applied will be sent free of charge to any tree owner who applies to the Government Entomologist, Agricultural College, Coimbatore. The tree owners living in Northern Circars can obtain the soap and the pamphlet by applying to the Deputy Director of Agriculture, No. 1 Circle, Anakapalle.

The 7th Meeting of the Board of Industries (Education Section) was held at Cawnpore on 26th November, 1919. Amongst the matters disposed of were applications for increase in the grants in aid to several industrial schools. The proposed curriculum for the carpentry and smithy classes recently started at the Central Weaving Institute, was laid before the Board. Similarly also were proposals for establishing a Machine workers' class at the Government Carpentry School, Allahabad. Estimates for improving the equipment of this school were also framed. The next meeting of this Section of the Board is to take place in Benares, early in January, 1920.

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Representatives of an American aluminium concern have recently arrived in Japan, according to the Press, to confer with Japanese aluminium interests in the formation of a company, the proposed capital of which is yen 10,000,000, the Americans to take one-half the shares and the Japanese the other. The parties are in negotiation with the Japanese Government for water-power rights in Toyama Prefecture. The American company, having agreed to transfer to the Japanese all its manufacturing rights and technical experience, do not wish that the shares to be offered in Japan should be open to public subscription.

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H. M. Commercial Secretary at Yokohama writes that official plans are being prepared by the Japanese Government for the establishment of Commercial Commissioners in foreign cities to forward Japanese trading interests. While the Department of Agriculture and Commerce has been able, in the past, to obtain commercial reports from Japanese Consular officials such reports it is stated have proved of little use for practical purposes. It is, therefore, deemed advisable to establish offices of Japanese traders in order to expand the country's commercial power throughout the world.

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The Minister of the Interior of the Canadian Government has made an arrangement between the Hydro-Electric Power Commission of Ontario and the Water Power Branch of his own Department for the purpose of a thorough water recourse and power investigation of the Province of Ontario. This joint agreement has been given effect by Order-in-Council, and the investigation will be carried out under the supervision of the Director of Water Power of the Department of the interior. A skilled hydrometric survey staff will be organized and put to work without delay.

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A company has been promoted in Yokohama with a capital of yen 2,000,000 for the purpose of manufacturing pulp from seaweed, called "ajimo," and to manufacture paper of all descriptions. In view of the abundance of suppliers everywhere and also of the fact that pulp made from seaweed requires a comparatively small quantity of chemicals for the manufacture of paper, the promoters of the company are most optimistic about the success of the undertaking. Almost all of the shares of the company have been taken up by the chief promoters.

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We acknowledge, with thanks, the receipt of an excellent likeness of H. R. H. the Prince of Wales from the *New York World.* We understand that it was issued as a supplement on fine paper by our well-known contemporary as a souvenir of H. R. H's visit to the States. Six-hundred and twenty-five thousand copies were, we are told, printed and distributed. We congratulate our contemporary on its public spirit and enterprize. The artistic merits of the likeness deserve commendation.

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The Colonial Report for 1918 (No. 1007) states that some beds of monazite sand have been discovered in Ceylon, and a special plant for the treatment of a bed of this sand near Bentota was erected during 1918. The plant has worked successfully, and by the end of the year some 20 tons of refined sand had been separated, and will be shipped to England when an opportunity occurs.

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We publish in this issue Dr. Murry Stuart's report on the possibility of smelting electrically the Kanjamalai iron ores, situate in the Salem district of the Madras Presidency. We have no doubt the Report will be read with interest in view of what is being attempted on these same lines in the State.

GLEANINGS.

An interesting but rather curious method of cultivation for the production of large (papai) fruits is sometimes practised, says an exchange, in Malaya. When the plant is three inches in diameter at the base, a hole is bored in the trunk, about six inches from the ground. The hole is made about an inch deep and sufficiently large for a piece of rubber tubing to be inserted. A quart bottle is half filled with sugar, and water added. When the sugar is thoroughly dissolved the bottle is connected to the hole by a piece of rubber tubing. In twenty-four hours the tree will have absorbed the contents of the bottle. A gunny sack is wrapped over the lower fruit and trunk to hasten the ripening of the fruit. It is stated that, if these directions are carried out, fruits averaging ten to twelve inches in diametre will be produced. During the fruiting stage, several of the smaller fruit should be removed, to allow the remainder proper development.

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The control of electrical machinery by the sound of a whistle at any distance up to a mile was recently demonstrated to a *Sunday Express* representative. By the blowing of a whistle a small motor-car was started, directed to the right or left, and stopped by repeated sounds. The model was fitted with the essential batteries, and no wires or wireless apparatus are claimed to have been used. Vibration alone is responsible, and the same results are claimed to have been accomplished by means of inaudible vibrations. The inventor, Captain A. J. Roberts, an Australian flight captain, is said to have produced other inventions connected with wireless in the air and the controlling of torpedoes by the same means.

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With a view to check the practice of adulterating castor oil before export, it has been suggested that the Government should provide facilities for the examination of the oil and the issue of official certificates of purity. The Government have considered the suggestion and have decided to allow the Chemical Examiner to test free of fee such oil as is sent to him by firms and individuals approved by the Director of Industries and to grant in each case a certificate showing the standard of purity attained. The scheme is entirely an experimental one and will come into force from the 15th January, 1920.

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The *Agricultural News* says:—"Experiments conducted in France begun in 1911 in order to find out if there is any truth in the popular supposition that the moon exercises an influence on the growth of plants. In the latest trials, planting at the time of the new moon gave the greatest yield in twenty-eight cases, planting in the first quarter in twenty-nine, planting at the time of the full moon in twenty-eight, and planting in the last quarter in twenty-seven. This shows that no material difference in yield could be attributed to the influence of the moon."

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The following telegram was received on 3rd January from the Secretary of State. Fiji. Following telegram from Governor, Fiji, received at Colonial Office:—"January 2nd. On unanimous advice of Executive Council and with concurrence of Council of planters and majority of elected members I have issued order cancelling all indentures of East Indian labourers from this day. Please inform Government of India. Rodwell."

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It is stated in the American Press that two blast furnaces are to be sent from the United States to the Tata Iron and Steel Company at Jamshedpur. A charcoal blast furnace is also being made for the State of Mysore, and a contract has been accepted to supply a 350-ton blast furnace for the Indian Iron and

Steel Company. The latter company proposes to erect three blast furnaces, by-products coke ovens, benzol plants, etc.

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In the ordinary process of silvering glass mirrors by chemical decomposition the metal is deposited upon the glass container. In this manner a great deal of silver which might have added to the thickness of the mirror is lost. This is an important item when silvering mirrors 25 cm. or more in diameter. A note appears in *Science* from Mr. W. W. Coblentz, of the Bureau of Standards, calling attention to the usefulness of ordinary "granite-ware" enamelled iron pans, which do not attract the silver, and hence increase the supply of material available for deposition on the mirror. During the past year he has had frequent opportunities to verify this observation and to apply it in producing thick deposits of silver on glass.

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The Travancore Darbar has been of late taking steps to advance industrial development in the State. Some time ago the Director of the Industrial Department of the State recommended opening a pencil factory. A private firm agreed to carry out the scheme if they were given a free site. Government have sanctioned the proposal and provided a site, and has also ordered the supply, on payment, of five to six hundred candies of soft wood by the Forest Department.

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The output of electric energy of the central stations of the United States increased from 2,507,051,000 kilowatt-hours in 1902 to approximately 28,000,000,000 in 1917. According to Mr. H. C. Hoyt, of the General Electric Company, twenty years ago only about two per cent of the total electric energy was supplied by central stations, but to-day about 33 per cent is purchased from them, furnishing 10,000,000 horse-power in electric motors.

A water-power survey is being carried out in Japan in order to investigate the possibilities of hydro-electric power production for industrial power purposes. The survey will extend over five years and will cost 830,657 yen. The total power of the falls to be investigated is estimated at over 5,000,000 h. p.

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A Report issued by the Japanese Cotton Spinner's Union shows that net profits obtained by thirty-five cotton spinning companies in Japan during last year amounted to 109,014,000 yen,—a record since the inauguration of the spinning industry some thirty years ago.

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The water-power possibilities of the Dutch Indies have recently been surveyed. The water-power so far discovered amounts to about 1,000,000 h. p., aud it appears that conditions would allow of power stations of 100,000 h. p., being established in certain districts.

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The railless electric traction service of Shanghai, which has now been running for nearly four years, is the only one of its kind in Asia. There are seven cars on the route, and last year they carried some 5¾ million passengers.

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At the beginning of 1919, the number of motor vehicles in the U. S. A. was calculated at over 6½ millions. Since then the output of American manufacturers has increased enormously and the figure quoted is already far out-distanced.

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The war is responsible for the prosperity of the celluloid industry in Japan. In 1914 the output was 525,826 lbs. valued at 522,344 yen. This rose rapidly until it amounted in 1918 to 3,240,454 lbs., valued at 5,190,408 yen.

TOPICS FROM ECONOMIC PERIODICALS.

THE VALUE OF ARTIFICIAL MANURES.

The *South African Sugar Journal* says:—

There are many parts of this country where the old belief that soils can go on yielding for ever without any sort of replenishment of used constituents still keeps the cultivators from making the best use of their farms. Of course it is a fatal error. But notwithstanding that artificial manures have become an indispensable part of modern farming operations, nearly all the important chemical fertilizers are of comparatively recent introduction. True, lime and bones had been recognised early as having a beneficial effect on farm crops, as had several substances not properly plant-foods but, previous to the nineteenth century, the farmer had to rely on the natural product of the soil to provide the necessary elements of fertility. The soil of a country represents an accumulation of wealth which has taken ages to establish, and which is the most precious of all national possessions; it can be exhausted by bad farming until its annual produce is so small as to render it unprofitable, but complete exhaustion is impossible.

Each year natural agencies render available a small quantity of plant-food, and in addition a very limited amount of fertilizing matter is brought down from the atmosphere. This process carried on throughout the ages, without any drain on the soils, results in great accumulations of fertility in virgin soils, but immediately these lands are put under the plough, a loss of the soil fertility takes place, leading eventually to exhaustion unless a means is found of replacing the elements of plant-food removed.

In the four-course rotation, when average crops are produced, 73 lb. of nitrogen, 22 lb. of phosphoric acid, and 61 lb. of potash are removed from the land annually when the whole crop is sold off. Successful crop-production does not depend entirely on plant foods; the mechanical nature of the soil is a factor of prime importance, as also are drainage and cultivation; but exhaustion of the plant-food will render all other influences inoperative.

The introduction of artificial manures was perhaps the most important advance ever made in agriculture, as soil fertility is the basis of all success in farming; farmyard manure contains a very small percentage of plant-food, and, however important its bulk may be in the physical improvement of the soil, the amount produced per acre under natural conditions is too small to give maximum crops when returned to the land. Even the most fertile land produces, under natural conditions, too small quantities of manure to maintain its fertility. Without artificial manures many farm crops cannot be produced at all at a profit—a great extension of crops has grown with the use of artificial manure. The value of bones—especially ground bones—was early recognised by farmers, and there existed a very marked prejudice in their favour.

Farmers, as a class, fear the use of any manures which they believe will cause exhaustion. Peruvian guano—the droppings of sea-birds deposited in the rainless districts of Peru—was introduced as a manure in the early forties and, as it contains the three most important elements of plant nutrition, it gained a popularity almost equal to that enjoyed by bone manure. Soon after the introduction of guano the use began of nitrate of soda, sulphate of ammonia and potash salts, and LIEBIG discovered that bones were rendered much quicker in their action when dissolved in sulphuric acid. This discovery suggested to SIR J. LAWES the use of phosphatic rock as a manure and he took out a patent for the dissolving of mineral phosphates in sulphuric acid, the product being superphosphate.

The proper use of artificial manures was at first not understood, and even to-day much ignorance exists among practical men in this matter, leases still being in existence where the use of nitrate of soda is forbidden. Agriculturists throughout the world owe a debt to SIR JOHN B. LAWES, who founded at Rothamsted an experimental station—now world-famous—to investigate the action of chemical manures on crops and the soil, and it is on the knowledge gained from these experiments that the whole science of manuring is based. Experiments of this kind prevented manures of fundamental importance, such as nitrate of soda and sulphate of ammonia, being banned entirely in agriculture, as, until the nature of those manures was understood, they probably did more harm than good, owing to the way they were applied.

As in the case of lime, the effect of quick-acting nitrogenous manures on many crops is so potent that it was quite natural for the former to jump to the conclusion that, to obtain great yields, it was only necessary to apply one or the other of these manures. The effect of applying soluble nitrogenous manures frequently, without at the same time giving mineral manures, is now well known, the plots at Rathamsted, which received dressings of sulphate of ammonia annually, being now practically barren. Thus artificial manures are of comparatively little use to

the farmers without knowledge of how to use them properly. Instead of purchasing chemical manures, many farmers prefer to spend the money on concentrated cattle foods, trusting to the large manurial residues left in the dung to give the required plant-food. This method makes it possible to maintain a larger head of stock on the farm, from which it may be possible to take a profit, and, in addition, often gives better results. Under certain conditions of soil and climate, land can be more effectively improved by feeding the manurial constituent required by crops in the form of concentrated foods to the farm animals, securing enriched farm-yard manure, which on many soils, is particularly effective.

The introduction of basic slag as a manure, placed in the hands of a farmer, is one of the most valuable aids ever bestowed on the industry. Basic slag is a phosphatic manure with a basic character, and owing to this condition, it can be applied to sour pasture land, the results being marvellous, often doubling the stock-carrying capacity of the land. A dressing of from 5 cwt. to 10 cwt. per acre will cause a dense growth of the most nutritious of all pasture plants—white clover—to appear, which nourishes with nitrogen the surrounding herbage. Where the grass is so coarse as to be refused altogether by stock before the application of the manure, the change brought about in the herbage is so great that, as a result of the slag dressing, the land is grazed as close as a tennis lawn.

The effect of artificial manures is well shown in the Rothamsted experiments, which have been :arried out over a sufficient number of years to :liminate all seasonal influences. The average yield)f hay per acre for upwards of forty years was 23·2 :wt. per acre, without manure, whereas from the ›lot receiving a dressing of superphosphate and ulphate of ammonia an average yield of 35·5 cwt. of ay was annually obtained, an average increase in ield of 12·3 cwt. per acre. The high yields of heat obbained in England, Denmark and other ighly farmed countries, is largely due to the system : rotation of crops and the large head of stock ›pt; the Rothamsted experiments, however, show at without the aid of stock heavy crops can be obined by the use of artificial manures.

THE SMALL INDUSTRIES OF INDIA.

Mr. H. W. Wolff, the great authority on Co-operation, writes in the *Bombay Co-operative Quarterly* :—

There are two distinct tendencies now observable in the co-operative movement in India, which are of great promise for the future well-being of the people. The aim of one is the multiplication of co-operative stores, to supply the people with cheaper and better, certainly more trustworthy articles of consumption, dress, household implements, and other domestic and personal requirements. Experience in Europe shows how marvellously co-operative distribution may benefit and emancipate the humbler classes on a large scale. And prospects in India are distinctly favourable. The matter is there also more important, inasmuch as the number to be benefitted is greater, and fraud and overcharge appear to be more rife. There is now also more provision made for an easy original supply of goods to be dealt in at the store, than there was when the movement began in Europe. I think I may answer for it that, if a distributive movement is vigorously set on foot in India, the English Co-operative Wholesale Society, which is the best and cheapest universal provider for stores in the world, would meet such movement with good will, and do what it legitimately could to further it.

The other tendency referred to is of no less importance and promise. It is for pushing the development of the small industries, which in India appear to be a very necessary and ideal economic stand-by for the vast population, as if marked out specially as such by Providence. There are people ambitious to see large power industry growing up in India. Let it be so! Everything that aids to provide employment and increase production will be a gain to the huge empire. But, whatever be the development of such power manufacturing, it cannot, for a long time to come, cover more than a very small portion of the space to be provided for. Besides, I put it to any one who knows India, whether the Indian appears at all cut out for wholesale monotonous and wearying mill-work, in more or less close and shut up, unhealthy rooms, at a steady grind, away from his house and little field. For it is, of course, of the country population rather than the urban that I am now thinking—as is, presumably any one who busies himself with thinking at all about this subject. The store movement is likely to develop most rapidly and extensively in urban areas. It is the dweller in the country, in his more or less

isolated village, with a field or two to cultivate, who needs small industry, though not probably, as a rule, as a main employment, but as a make-penny supplementary occupation, to fill up time which he would otherwise waste, and earn him some additional rupees. How usefully cottage industries, as they have been called, may act in this way we see in many parts of Europe. I have been through—mostly on foot—the principal areas, in which cottage industries are practised—except in Russia, where there are many thousands of *kustar* artels in which small folk, who also cultivate land, ply their humble trade. And it is gratifying to hear the click-click of the handloom in the smallest cottages, say, on the mountain sides of the Foudai valley, to see in Lorraine women and girls working away eagerly at their embroidery—which is the best paid small industry going—the Black Foresters making their parts of clocks and watches, the Truringian peasants shaping their meerschaums, and the maidens and children of Tuscany plaiting their straw. It is all so picturesque! But it also tells of money earned by labour which would otherwise run to waste. However, the classic country for small industry—which in this case includes fishing—appears to be Japan. There small industry and fishing fill up a large space in the country's production and draw much money into the humble homes of poor but industrious people. Here in England, we see the second chapter of that commendable Japanese home industry—in the "Japanese Departments" of our great stores, in which Japanese articles, for the most part produced in cottage homes, are offered to the public in striking variety and sell exceedingly well.

That, I confess, has made my mouth water on behalf of India. India is not far distant from Japan. It has a population very similarly circumstanced. Only the other day, I read in an Indian paper of the growing difficulty exising in India out of the great pulverisation and splitting up of small landed property, which yields to its owners less than even a poor pittance. Why should not the rayat, with his minute parcel of land, do as does the Japanese peasant, who ekes out a living, by the side of what his all too small holding will render, by fishing, basket-work or some similar by-occupation? India, no less than Japan, is the land especially of small industries. There are numbers of them. Mr. Ewbank some time ago gave us the number of those who practise them in the Bombay Presidency. Professor Mukherjee counts up a considerable variety of such industries in his book, "The Co-operative Movement in India." Mr. Chatterjee has a long catalogue of them to give in his report on the United provinces. The evidence given before the Indian Industrial Commission—only just made public in England—is full of references to them.

As regards competition with that more showy power industry, for which, carried away by the gloss of its magnitude and its supposed magnificent profits—often enough now-a-days reduced by strikes, of which small industry knows nothing—certain economists have conceived such preferential admiration, there is no fear whatever that small industry would not be able to hold its own—provided that its devotees select the right class of articles to manufacture. Power industry is indeed increasing rapidly and making a great show of its growth. However, small industry is advancing no less steadily, although with less of *reclame* and blowing of trumpets.

But, on the other hand, it is quite true that small industry has everywhere certain rather formidable adverse conditions to battle with. In the first place, frequently enough, there is a want of technical skill among those who carry it on, often enough with faulty old-world tools, being wedded to old traditional methods of production, which have become out-of-date. I should not, judging at a distance, hold that the monopolisation of certain industries by distinct castes is necessarily a serious hindrance. Continued practice, handed down from generation to generation, in a caste rather suggests useful accumulation of experience and inherited familiarity with the particular work. Every trade has its own peculiar knacks, which must be learnt. But when the familiarity becomes stationary, that indeed tells against good execution. On the other hand, such exclusive practice tends to impress upon the articles made the valuable stamp of characteristic originality, which make them prized. In Germany, where for various reasons small industries are much encouraged and patronised by the authorities, Governments seek systematically to meet this difficulty of backwardness in skill by providing technical schools and demonstrational exhibitions, the outlay upon which from public funds, under the circumstances, appears legitimate, inasmuch as what is in them given is teaching, not a subsidy to business. Something of the sort might be practicable in India.

Another difficulty to be contended with is that of money wherewith to purchase raw materials or tools, or else to store goods or hold them over in times of slumps. For that difficulty it may be hoped that co-operative credit may provide a remedy. Professor Kuwada in Tokyo to whom I wrote, inquiring about the measures understood to have been taken in Japan, as I have more than once been told, to encourage and promote cottage industries, are closely interlinked and interwoven with co-operation, which we know is—more particularly on the credit side—extensively practised in Japan. The two subjects appear there

to have become practically one, and both thrive—which is a promising augury for their interconnection in India. Well, co-operation there is in India, as well as in the Empire of the Rising Sun, and it is doubtless capable of the same good services.

However, the most serious difficulty of all to overcome is that of finding a market for the products turned out. It is a universal experience that persons engaged in cottage industries, when unsupported or unorganized, fall an easy prey to middle-men, who constitute the only means open to them for disposing of their wares, and who fleece them unscrupulously and very effectively. As matters stand now, the dealer has the whiphand of the small manufacturer by reason, in the first place, of his command of ready money, against which the maker of the wares has nothing to pit but an empty pocket. That defect, it may be hoped, as has been said, co-operative credit will remove. However, our bania has another powerful advantage over his victim. He knows the *market*. The maker does not, and could not if he knew it, at all cultivate it. For that would mean much expenditure of time and travelling, such as he is not equal to. Now I am afraid that the practisers of village industries have added to that advantage possessed by their adversary by falling into the same error which we know that our manufacturers in Great Britain have dropped into, namely, that of considering their own facilities for production and their own taste in the product turned out, rather than the tastes and needs of those whom they look to, for buying their goods. It is in this way that we in Great Britain have lost so much business in international trade to our rivals in Germany and the United States, who have been assiduous in studying other people's tastes and adapting their production to them, by which means—even apart from any advantage that they could give their customers in the way of lower prices or longer credit—they have captured the market. The market is tbe geat crux.

Now co-operation may do a great deal to get over this difficulty. Producers organizing themselves as co-operative societies may employ their own salesmen, knowing the market as well as the bania—just as our wholesale distributive societies employ their travellers, and as our agricultural co-operative societies employ their own scientists and technical experts. But that is a work of time—and in India, so there is reason to fear, of not a little time and trouble. Emporia for the exhibition and sale of goods, such as Lady Carmichael has public spiritedly created in Calcutta, may do good. In Europe they have not answered over well. But India is the land of bazaars. And, circumstances being different, results may be so too. But probably such exhibitions will mean only advertisement. And, being confined to goods made under peculiar circumstances, naturally only people interested in those particular circumstances can be expected to visit them, and see, and buy. Now that necessarily means a restricted market, rendered probably more restricted still by the production of articles such as patrons of them will purchase from good will, to find them look pretty, and to show their sympathy, whereas for the numbers engaged a large market is required. An emporium frequented by the general public, as a matter of course, in incomparably larger numbers, might be found more serviceable. Seeing those "Japanese Departments" that I have spoken of in our London Stores, and being advised of their success, it has worried me not a little to think that "Indian Departments"—are conspicuous by their absence why should we not have "Indian Departments" especially at the present time, when British patriotism is so strong among us our public desires to boycott enemy-made goods and buy by preference what is made under the shadow of the Union Jack. I ventured to put the question why India is not favoured like Japan—India being a bit of ourselves, whereas Japan is after all only a highly valued, loyal Ally—to the manager of one of our great London Stores. His reply was that Indian goods are not found to sell. The Japanese manufacture articles of general utility, such as lacquered ware, basketwork, and the like. For such there is always a market. Indians have sent mainly knick-nackery—irory, silver and shell ware—and the like, all very artistic to look at and interesting and commanding a certain demand, but by no means a large one. My friend's establishment could not undertake the risk of speculating in such things. However, he made me this proposal. If a consignment of Indian goods, of general utility, were to be delivered to him "on sale or return" he would, as an experiment, make a very good show of the wares by themselves in a distinct department. And then, we should see what the result might be. If the experiment were to succeed, the establishment's own interest would, so I hold, lead it to go on with its "Indian Department." And if it were to do so, other large establishments of the same sort would infallibly, necessarily, have to follow suit. That would mean that many thousands of people, not coming to the stores specially to buy Indian articles, but to purchase just what they might want or fancy, would pass through the Department, being naturally attracted to it, at first by its novelty, and later by the abiding interest, which we English naturally feel in India, as well as by the knowledge that they would find something or other there that they would be glad to buy.

Now, this offer, I should say, ought to be acted upon. It might, if successful, prove a substantial

gain to those small industries upon which for a long time to come, India is likely in part to be dependent, and which, carried on at a sufficient profit, must mean prosperity and happiness to millions of our Indian fellow-subjects and, through them, an accession of wealth to the entire community. The way to execute this will be to find public-spirited people—such as there are in great number, taking an interest in India's welfare, prepared to charge themselves with the risk of the goods not finding purchasers. It will be for people in India to begin. That done, I think we may expect that equally public spirited Anglo-Indians in the United Kingdom will also come forward to join in the venture. In this way, the ground might be tested and possibly a good move might be found to have been made.

However, there is a second condition to observe. The goods sent must be such as a European public would be likely to buy. We could do with a little of that artistic knicknackery which we so much admire and in the making of which Indian craftsman exhibit so much skill. But the bulk of the consignment must consist of articles of general utility, such as Indian carpets, which would probably be sure to sell; for they are greatly appreciated in the United Kingdom. It will be for people in India, interested in the fate of the indigenous workers, to consider whether they can give their help. I venture to hope that, for the good of those workers and of the country, it may be found possible, and that, the attempt having been made, it may, please God, be carried to a successful end.

ECONOMIC NOTES.

AGRICULTURE.

Agricultural Pests.

The Madras Publicity Bureau in one of its recent leaflets says :—

All agriculturists know the damage caused from time to time by the numerous pests which attack paddy : much less is known of the work done by the Agricultural Department in endeavouring to find a remedy for these pests; and it is not surprising that indignant correspondents write from time to time to the papers wanting to know what the Agricultural Department is going to do about it and why no instantaneous remedy is provided. These sufferers can hardly be expected to consider how numerous are the pests that attack the different crops which the Agricultural Department is required to protect, how short a time has elapsed since these pests first began to be studied scientifically, or how much patience and ingenuity nature requires of her cross examiners before she will give the information which they are anxious to elicit. Human diseases have been studied uninterruptedly by a special class of scientists in Europe at least, for over three hundred years and we know to our cost how little can yet be done to combat some of the most important and deadly diseases. It is hardly fair to expect the Agricultural Department to find a cure for all the ills that beset our South Indian crops in 20 or even 50 years. It is more interesting and more encouraging to inquire what the Agricultural Department is doing than to find fault with it for what it has not done. The following account of a small experimental operation which is being carried out by the department in a tract in the Godavari delta may help to explain something of the methods which the department employs and the difficulties which it encounters.

Two of the commonest paddy pests in the Godavari delta are : the Spodoptera mauritia (the paddy swarming caterpillar) and the Schenobius bipunctifer (the paddy stem-borer).

The Agricultural Department are now fairly confident and they know a method by which the first pest can be checked, provided that water is available. The method recommended is the timely flooding of the fields with the use, if possible, of a little kerosine-oil. The caterpillars climb to the top of the blades of paddy and can then be knocked off into the kerosined water by dragging a rope over the field. But with regard to the second pest the department is doubtful whether any effective method of combating it has yet been discovered, and it holds that further research and experiment is necessary.

The second pest, the paddy stem-borer, is a small yellow moth which lays a mass of down-covered eggs on the leaf of the paddy plant. From the egg comes out a minute caterpillar which makes its way down to the base of the ear head bearing shoot and bites its way into it. There it stays, grows and feeds till it has reached its full size when it wraps itself in a silk cocoon and awaits its transformation into the moth. The central ear bearing shoot of plant whose stem is thus hollowed out withers and dies. These characteristic withered shoots (Telugu, Usateru; Tamil, Venkatiri) are well known to the ryot who with less than his usual acuteness attributes the withering to an unfavourable wind ignoring the caterpillar which is the real culprit.

At one time the Agricultural officers were inclined to recommend light traps to catch the moth of the paddy worm, but experience has shown that though

many moths were caught in the traps yet the number was not sufficient to make any appreciable difference to the damage done to the crops. The Government Entomologist has hopes that a really effective trap could be designed if we know what it is in the paddy plant which attracts the moth to it. In the United States of America, two organic chemists after much research were able to discover an essential oil which attracted the cotton boll worm to the cotton plant. The experimental stage has not yet been passed, but it seems probable that by means of this oil a high percentage of the boll worm could be dropped and destroyed. But in order to find the attractive principle in paddy it would be necessary to depute an organic chemist to study the paddy plant from this point of view for an indefinite length of time. If this were done, it might be possible sooner or later to discover a substance which would enable us to devise a really effective trap for the paddy stem-borer. But a highly paid officer, time and patience would be needed for the work and there could be no guarantee that success would ultimately be achieved.

Meantime the Entomologist is trying to find other simpler and quicker means of combating the pest. For this purpose the Narasapur taluk in the Godavari delta was selected, and a special staff of Agricultural officers was sent to work there under the Entomologist's directions. The instructions of the staff were to spread among the ryots a knowledge of the life history of the paddy swarming caterpillar and the stem-borer to explain and demonstrate the recognized method of checking the swarming caterpillar by flooding and to investigate the best method of combating the stem-borer.

It proved impossible to carry out one part of the campaign, because the swarming caterpillar did not appear in any considerable numbers in the tract this year. This is a characteristic example of the difficulties to be faced in dealing with these insect pests. They appear and disappear in such an irregular and unexpected manner that it is difficult for the Entomological officers to be on the spot in time to study the early stages of the pest and it is difficult to be certain whether the appearance or non-appearance of a pest is due to the remedial measures taken or to other natural causes. As this enemy, the swarming caterpillar did not appear the Agricultural officers had to be content with orally explaining to the ryots what they should do hereafter when the pest next appears.

As regards the part of the campaign which was directed against the stem-borer the Entomologist had no hope of finally defeating the pest in this season. His object was to study experimentally the best means of combating it and by putting the ryots in possession of the facts regarding the life of the caterpillar to secure their co-operation in devising means to destroy it. *Prima facie* the most hopeful methods of attacking the pest were by collecting and destroying the egg masses that are laid on the paddy leaves or by collecting the withered paddy stems in which the caterpillar resides or by destroying the stubble after harvest as at that season the caterpillar finds shelter and nutriment in the stubble. The Government Entomologist knew from his African experience that children in rural tracts might be most useful in a campaign against a pest. They are easily trained to find and recognize a caterpillar or moth or its eggs and they find amusement in the work especially if a small prize is offered for success. The educational authorities were therefore approached. They readily recognized that such a practical training in natural history had a very real educational value, and they agreed to aid in inducing the children in the tract to assist in the collection of the eggs of the moth. A short lesson has now been prepared for use in rural schools of this tract explaining the life history of the pest.

But the experience so far gained in the campaign goes to show that the most hopeful means of checking this pest is by picking out and destroying all attached seedling at the time when the seedlings are taken from the seed bed for transplantation. The ordinary coolie is already able to recognize the seedling effected by the pest. Thus by a little extra expenditure on labour the worm infested seedlings could be destroyed while the crop is transplanted. If this were done systematically over a considerable tract, it appears probable that the numbers of the paddy stem-borer and the damage done to the crop would be appreciably reduced.

Another opportunity for checking the pest occurs after the harvest. At that time a generation of the caterpillar is living in the stubble left on the ground, while the daincha which has been soon before the harvest is allowed to grow up. The caterpillar lives either exclusively or at least chiefly in the paddy plant or in its stubble. The moth's life is short. Thus if there is no paddy or stubble on the ground for considerable period, the whole race of the paddy stem-borer or all but a few specimens is likely to perish. The Entomologist therefore advises that the sowing of daincha which is now done before harvest should be postponed and that the stubble should be ploughed in and destroyed. If this were done over a considerable area, it is hard to see how the paddy stem-borer could escape disaster.

Accordingly the Agricultural Department now proposes to obtain the permission of a ryot to cultivate on these lines a block of 100 acres in Tanuku taluk in the Godavari delta, for a period covering at least three paddy crops. It is hoped that the results obtained will be sufficiently good to warrant the department in recommending these methods for general application in this tract, but time alone can show whether this hope will be fulfilled.

CO-OPERATION.

Co-operative Credit in the Philippine Islands.

Mr. A. W. Prautch, Chief, Rural Credit Division, Philippine Islands, writes thus in an American Journal :—

The Rural Credit Law (No. 2508) of the Philippine Islands was enacted to remove the restriction in the Corporation Law (No. 1549) requiring a minimum of £2,00,000 to be raised as paid-in capital before a bank could be started, and to provide rules and regulations which would insure the operations of these associations and safeguard the interests, of the small investors, the general public, and the Government.

The associations under the new Law may incorporate with a paid-in capital as low as £ 100 or as high as £ 10,000. The share-holders who contribute this sum elect their board of five directors, who approve or disapprove the loans, sell more shares, borrow more working capital, and manage all the affairs of their association. In practice, it works out that where they have active directors the work goes forward and where figurehead directors are selected, because of their social standing or prominence, the association lags, yet this very experience teaches the lesson of self-government more effectively than theory ever could, and there is always the opportunity at the next election to remedy the condition by changing the board.

The law specifies that only one association can be incorporated in a municipality. This is to avoid rivalry and factions. The provision that the bonded municipal treasurer shall act as treasurer, ex-officio, without extra remuneration, and that Government auditor shall audit the accounts when the municipal accounts are being audited inspires the simple investors with confidence in the association. They are thus satisfied that their few pesos are safe. Possibly, no other single feature has contributed more to our success than this wise provision to protect the funds.

All payments are made by the treasurer on vouchers passed by the board of directors. No individual can own more than £ 500 in shares; each shareholder has only one vote irrespective of his shares; associations enjoy certain exemptions until their paid-in capital stock is £ 10,000. Among these are: no taxes or revenue charges, no stamps required, no registration fees on mortgages or documents, no court fees on the collection of unpaid debts, etc. The Government furnished no financial help, directly or indirectly. These exemptions are given until the association is on its feet, and can pay its way. The organizing staff is paid by the Government, because otherwise no one would systematically and continually push this solution of how to provide the working capital for small farmers by organizing them into a "home defence guard." No one in the accociations receives pay; their public spirit and civic pride are appealed to. The forms, supplies, books, share stock forms, etc., are paid for by the association out of a fund made up of a small entrance fee from each member. Everything aims to develop self-help. The agents never do for an association what it can do for itself, nor do they omit to point out the dangers learned from their own experience of a doubtful course, and the advantages of right management. Of course, anything contrary to Law 2508 is sternly stopped and the reason is clearly stated. The character of rural credit associations must, like Cæsar's wife, remain above suspicion, a condition that would not continue without a Government staff to advise and guide in this apprentice period.

From this incomplete introduction to our system we will proceed to the working out of the plan in practice. Our organizing staff visit towns, distribute copies of Law 2508, point out the benefits the whole community will reap if the small farmer can keep for himself the usurious interest now exacted for the loans he must have. It is also pointed out that this interest stays in the town instead of going to the capitalists in the large centres, and that in time a strong village bank will be the result of this co-operative effort. People who are not borrowers are urged to buy shares in order that a worthy institution may have funds to loan out. If enough interest is manifested they proceed to organization. A meeting is called and those who have subscribed and paid for shares select the incorporators, of whom there cannot be less than five or more than fifteen. From these the five directors are selected to serve until the first share-holders' meeting is held, when these or other directors are elected. The incorporation papers are registered without expense to the association. The directors then receive applications for loans and approve or disapprove them. Their action is final. If an aplication is approved a voucher is drawn on the treasurer and the money is paid to the borrower. The law compels security to be exacted for all loans, this may be :—mortagage on land, pledge of work animals, etc., or endorsement by "two persons of recognized solvency in the community." We work only on the personal guarantee, because the loans are small and if the borrower is doubtful or trickly his application is disapproved by the directors. We even begin a step further back and refuse admission

to membership to such characters, which reduces the number of refusals. These accociations are not an attempt to reform loafers or to provide easy money for the careless, but to unite earnest, labourous farmers in a co-operative self-help association.

When the paid-in capital is £1,000 or over, an association is permitted by the National Bank to borrow a sum equal to its capital on the security of its capital and a joint and several note of the five directors, whose assessed property is certified to by the municipal treasurer. The National Bank also loans larger amounts to associations on the joint and several security of the growing crops, stored produce, work animals, sugar mills, etc., of the members, the mortgage being made out in favour of the association, which is a corporation, and this accompanies the joint and several note of the directors. There is no maudlin sentiment or mistaken pity for the poor, but practical help for those willing to help themselves. The bank charges 8 per cent to the association, which charges its members 10 per cent the profit going to the association. Twenty associations have received loans aggregating £ 80,000. Jnst as fast as the members fully understand this plan and are willing to assume responsibility it is being adopted. No attempt is made to urge it on unprepared associations. This arrangement gives deserving, progressive associations more working capital when they are able to use it wisely and have learned by their own effort how capital is created. I consider the "apprentice period," with its experience, of the greatest importance for the associations.

The first rural credit association was incorporated on October 19, 1916. There are now (Sept. 2, 1919) 3,842 incorporated associations and over a hundred more in various stages of organization. The paid-in capital at incorporation was 1,64,846 which has been increased by further sales of shares to over 5,00,000. There are over 50,000 members who brought these shares. Loans aggregating over 4,50,000 have been made to over 6,000 members. Our official returns from the treasurers were made on December 31, 1918. This estimate, which I believe is within the figure, is made on the reports of progress sent in by our agents.

In addition to the above financial activities, the legislature designated the Rural Credit Associations to be the agents to loan out one million pesos to responsible persons who will plant uncultivated areas in rice and corn. The Secretary of Agriculture and Natural Resources finally passes on the applications received from associations. No loans can be made direct to individuals, the reason being that no central agency can possibly know the reliability of the applicant as well as the directors of his association do. The expense and trouble of investigation is obviated by making the total loan to the association under precisely the same conditions as the National Bank loans to associations, as explained above. The directors having assumed responsibility for the repayment of the loan will, for their own personal protection, exercise great caution to loan this money only for productive purposes and to responsible persons. The purpose of the million peso fund is to grow enough food in the Philippines to make importation of rice unnecessary. The people need work-animals to replace those lost through rinderpest, and money for working expenses to cultivate again the abandoned fields. Applications have already been received from 170 associations for loans totalling over £ 8,00,000. These are being carefully investigated. I believe it would have been very difficult, if not impossible, to have carried out these useful loans without the co-operation of the rural credit associations with their local knowledge and community of interest.

No one cares to read about failures. In justice to the 325 associations, I am compelled to say there is not one which can be styled a failure. Two hundred are making healthy progress, the others have ailments, which, while not fatal, retard their growth. Their chief trouble is that they have been unfortunate in the selection of their directors. Yet it is their own money they manage and their own salavation they are working out, so that errors will possibly be rectified when understood. We hope they will outgrow their infantile troubles and are encouraged by the signs of improvement. In three known cases, there were men on the boards whose interests suffered by liberating the poor. Naturally, they opposed progress, but even in associations thus handicapped a large number of members clearly see the light and time and ~~another~~ election will remedy the temporary set-back. We have some "one-man" association; when this one man is away the machinery stops. It is not possible to insist on our type of association unless we deprive the members of their initiative and liberty and do everything for them. If these are to be "worth-while" associations, they must be co-operative, and even if it takes years to put the backward ones on their feet we shall consider the time well spent.

To quote a few of the several instances of success; San Remigio, Antique Province, is a small, poor town. Its association asked to be incorporated on July 14, 1917, with only £ 94 cash in hand. Taking into consideration their condition this was granted. Six months later, the writer visited this humble community and found they had over £ 1,000 of their own capital, and all but four pesos was loaned out. At a meeting of all the members, I heard statements of loans as small as £ 7, which had been granted to

e needy. I secured a loan of £1,000 for this aliant association from the National Bank, which oubled their working capital. They worked on ith new hope, and in March 1919, they had completed 5,000 of their own paid-in capital. This with e money borrowed and deposited gives them a orking capital of nearly 10,000. One example of elf-development like this convinces me that the plan adapted to the people and that the people will adapt emselves to the plan. In Sibalom, Antique Prounce, at a meeting of the Directors and a dozen ading members, several speakers reviewed the appenings of the eighteen months of existence of eir association, and stated that the £6,000, their wn and borrowed capital, had given their members direct benefit of over £30,000. Formerly, they ad been compelled to repay each peso borrowed at lanting with a cavan (44 kilos, of unhusked rice. his year, the directors had supplied the really ecessary money and had advised applicants how do without unnecessary expenses, and had also lvanced needed money after harvest to enable the ower to hold his rice until the market improved id he could benefit by the rise in price when the ut was over.

It is impossible in this article even to enumerate e several hundred encouraging incidents in the arious associations. Let it suffice to say that the an we are following of making the "scholar" work it his own problem instead of putting down the orrect answers on his slate without his knowing hy or how the "answer" was reached, really bringing about the desired results. It would also interesting to write of the dozen women rmers who are incorporators and directors and of e score or more Roman Catholic priests, incorporators and directors, who are helping their flocks to ijoy some of heaven this side of the pearly gates, id of the hundreds of disinterested teachers, officials, and citizens who are doing their bit to improve e associations and communities. In closing, let e frankly state that the success is due to those in e towns who are willing to sacrifice time and lend eir influence to forward rural credit associations.

Our greatest problem is to impart an understanding the principles of rural credit to the large majority our members who know absolutely nothing about o-operation beyond that the plan, as presented to em, seemed good and they bought shares. Unless e principles of co-operation are constantly insisted these associations will degenerate into village oney lending concerns instead of being moral and cial regenerating centres. The possibilities for od of these associations are great. It will also be parent to all that if they are not carefully supersed and strictness in payments exacted, their possility for evil will be equally great. No defalcation or rious differences between directors have, however, curred so far. The earnestness of the agents and ell-wishers has kept the work at a high standard here we shall ever endeavour to keep it, while orking to increase the number of associations and eir efficiency among a people who have suffered uch through usury and welcome any plant that fers relief.

INDUSTRIES AND COMMERCE.

Madras Department of Industries.

The Madras Government have laid on the Editors' Table G. O. No. 1647, Revenue (Special), dated the 28th August 1919, containing the Administration Report of the Department of Industries for the year 1918-19. The following matters of interest are contained in the report :—

During the first half of the year the department was engaged chiefly in providing the supply of articles necessary for the war. It was only after the Armistice in November that the department could give the bulk of its attention to developing the industries for the time of the needs of peace. But before turning to the work which the department is doing now that peace has come and it will be interesting to see briefly what was done in this Presidency towards supplying munitions for the war.

MUNITIONS.

The following are the principal articles that were produced for use in the war. Great quantities of Indian leather were used for boots of soldiers. Coconut oil and castor seeds were exported and hay was sent from the Madras forest areas to meet the needs of the Army. Much timber was purchased on the West Coast to make boxes for packing food and other articles required for the Army.

CLOTHES.

The Buckingham and Carnatic Mills were fully engaged in producing khaki drill, cloth and tape for the Army. The Anglo-French and the Coimbatore Spinning and Weaving Mills had large orders for pugrie cloth and dusootie. The Bangalore Woollen Mills were engaged entirely in the manufacture of army blankets. The Mysore Department of Industries organized the manufacture of army blankets amongst the hand-loom weavers of the State. In the Ceded districts, the Madras Department of Industries arranged for the production of similar blankets. The tape-weavers of Chintadripet produced khaki webbing and tape for the Army. The manufacture of tents for the Army was undertaken in Madras. The Ministry of Munitions have found out that charcoal derived from coconut shells is specially effective as a protection against poisonous gas. Messrs. Tata & Sons arranged for the manufacture of coconut shell charcoal at Ernakulum and coconut shell charcoal worth a lakh of rupees was shipped to London before the Armistice. Great quantities of coir were purchased in Madras for use in the war for rope making

and other purposes. Bamboo and palmyra mats were sent to Mesopotamia to make huts. Besides this nearly a million tiles, 40,000 gallons of fish oil and 76 tons of soap were supplied for the Army. All the leather-making and engineering firms in Madras and Bangalore were working throughout the year at their full capacity in supplying the miscellaneous needs of the Army and the Madras carpenters also were keptb usy. Straps, bets, boxes for the cartridges, oil cans rivets, harness for horses, bits, stirrups, tools for digging trenches, telegraph poles, axle-trees, cart wheels, stretcher poles and many other things were made and supplied in great quantities.

We will turn now to industries which will be no less important in peace than in war. The Director of Industries points out that as Madras is not rich in metal wealth its industries must depend on the use of the agricultural products which our ryots can supply to our factories. The principal industries to be developed are therefore (1) the manufacture of leather from the hides of agriculturists' cattle, (2) the application of mechanical engineering and machines to agriculture, *e.g.*, the use of engines for pumping from wells, (3) weaving of cotton into cloth by hand-looms in villages, and (4) the use of vegetable oils which can be extracted from groundnut, gingelly coconuts and other plants which grow in this Presidency.

Hides and Leather.

The export of hides from this Presidency was under the control of the War Office while the war lasted. Six and a half crores of rupees were paid last year by the War Office for hides of cattle parchased in this Presidency. The tanning of goat and sheep skins had been forbidden as the supply of tanning material was sufficient only for cattle skins. The order against tanning of goat and sheep skins was withdrawn at the beginning of 1919. Owing to the scarcity of tanning materials the Government had to take control of avaram bark to prevent the price from rising too high. All the avaram bark in the Presidency was distributed at fixed prices to tanners in proportion to the number of bides formerly tanned by them. The Government also imported wattle bark farm South Africa for the use of private firms. Experiments were made at the Leather school in order to find whether the bark of any other Indian tree is useful for tanning. It appears that the bark of the *Anogeissus latifolia* can be so used and much of this was collected. Some of the bark was used by the tanners even in this year, especially in the neighbourhood of Ranipet.

Experience of control by the Military authorities has showed that tanners in India suffered a great loss on account of the prevalent practice of adulterating hides. The result of adulteration was that the leather was of bad quality and the market price for Indian leather was therefore low. The Military authorities were able to forbid the adulteration and the quality of the leather prepared by Indian tanners therefore improved and the price obtained was higher. The representatives of the Madras and Southern India Chambers of Commerce and of the South Indian Skins and Hides Merchants Association have decided to ask the Government of India to pass legislation prohibiting adulteration in peace time just as the Military authorities prohibited it in the war time. They believed that this will be for the profit of Indian industries.

Mechanical Engineering.

Owing to the war the cost of machinery and of the oil required to drive it grew very high. There was, therefore, little increase in the use of machinery during the year as it might not pay to purchase and instal a pump for irrigation at the present high price. Further the number of rice mills installed before the war was sufficient to deal with all the rice to be milled. There were, therefore, very few new engines erected during the year.

But it is interesting to note that an arrangement has now been introduced by which the noise of oil and gas engines can be decreased, while the smell and smoke coming from them is also diminished. It is proposed to fit this appliance which is called 'Exhaust Silencing Chambers' to all internal combustion engines erected by the department hereafter within the limits of a municipality.

Compounding system.—As there are in this Presidency very few skilled artizans who can properly look after repairing engine and other power plants in the villages the department nndertakes for a compounding fee of Rs. 15 per annum to inspect and overhaul any power plant three times in a year and also at other times if a special summons is sent. The owners of power plants found this arrangement convenient and are making use of it. The number of plants for which compounding fees were paid rose during the year from 143 to 158.

The owners of rice mills and other plants experienced great difficulty during the year partly owing to the shortage of rice and partly to the lack of oil for fuel. Special arrangements were made by the department with the Asiatic Petroleum Company by which supplies of liquid fuel oil indented for Calcutta were diverted to Madras and some fifty owners of engines in Madras succeeded in obtaining a share of this oil.

The power plants likely to be used in future.—The director points out that the price of oil has risen high and is likely to remain high; he therefore

thinks that in future it will be best to use engines which do not use oil but are run by burning waste products, such as rice husks or groundnut shells. In towns it is possible that electricity will be generated at one central station and distributed to the various mills and other power plants in the town.

Machines for shelling groundnut.—The best method for shelling groundnut was investigated during the year. At present groundnuts in this Presidency are shelled in two ways; one by hand and the other by machine. When groundnuts are shelled by hand the nut is first made wet so that the kernels can be easily taken out but the result of this is that the kernel goes bad rapidly. The oil produced from such kernels is rancid and bitter and not fit for food. It is only used for manufacturing soaps. Groundnuts shelled by machines are not wetted. In consequence they reach Europe in a better condition and a higher price is paid for them as they can be turned into oil to be used in cooking. Even now in the Ceded districts almost all the groundnut is shelled by machines and machines are also beginning to be used in Vizagapatam, Tanjore, Trichinopoly, Salem, Coimbatore and North Arcot. In these districts about half of the crop is shelled by machines. But South Arcot and Chingleput ryots still shell almost all groundnuts by hand.

Even the machines which are used for shelling groundnuts are not altogether satisfactory. The machines often break the kernels. The broken kernels go bad and a few broken kernels may turn all the nuts in a bag bitter. Attempts are therefore being made to devise a machine which will shell the nuts without breaking the kernels. A new machine is now being designed which, it is hoped, will reduce the breakages of the kernel to 6 per cent, whereas the old machine broke about 30 per cent. If the new machine proves satisfactory it is hoped that higher prices will be obtained for the groundnuts sent to Marseilles.

HANDLOOM WEAVING.

The department sends out two weaving parties to teach better methods of weaving throughout the Presidency. The first party was able to introduce some improvements in the mechanical contrivances used for weaving in the North Arcot district. Then the party went to Anantapur to make arrangements for the production in villages of blankets for the Army from the sheep wool that could be obtained from that district.

The second weaving party founded co-operative societies in Peddapuram and Berhampur and opened a Weaving school at Parlakimedi at the request of the Raja of Parlakimedi. In Ganjam district it succeeded in inducing the weavers in several villages to make use of improved weaving appliances. It also started a co-operative society at Ichchapuram which supplies yarn to weavers on credit. The manufactured cloth is taken back from them at a fixed price.

DYEING.

During the year difficulties were experienced in obtaining good dyes. American dyes of inferior quality were on the market, but not first-class dyes capable of resisting constant exposure to the weather were exported to India. Such dyes were formerly made only in Germany and Switzerland. But many firms in Great Britain and America are now engaged in producing their best dyes and it is expected that dyes of the best quality will soon again be obtainable in India. Some special alizarine dyes were imported by Messrs. Best & Co. under agreement with the Board of Trade in Great Britain. Import was permitted on condition that the dye should be sold to dyers only; and the Department of Industries arranged for committees to distribute the dyes in different dyeing centres.

TECHNICAL EDUCATION.

For many years the question of industrial education in Madras has been considered. But it was only last year that the Industrial Commission laid down a settled policy. In future, the department will be able to follow that policy without fear. The Madras Trades School which was founded two years before the issue of the Commission's report was organized from the first on the lines now approved by the Commission. The Commission has laid it down that the industries which are carried on in big factories cannot be successfully taught in industrial schools where there are no factories and that industrial instruction should be provided in classes attached to the existing industrial factories or workshops.

The Madras Trades School is the most important educational institution under the charge of the Department of Industries. The school was started in 1916 with 40 students and only two classes. There are now 250 students and classes are taught in the following subjects:—

(1) Mechanical Engineering.
(2) Plumbing.
(3) Electric Wiring.
(4) Machine Drawing.

There are also special classes taught in the vernacular for maistris in wood-work, and in building. There were railway classes for 30 apprentices at the Perambur Railway Works and the number has since been increased. These men are taught machine drawing and machanics. The attendance is good and the men and boys are taught to work what is

being done in the workshops and mills in Madras. Only those who are already engaged in an occupation taught are admitted to the school.

It is interesting to notice that many well-educated boys are now entering Engineering and similar trades in which they have to work with their hands and to undergo a practical training in workshops which are engaged in a profitable trade, while they get theoretical training in the Trade schools. Formerly the number of well-educated boys who were willing to undertake practical work in workshop was very much smaller. Much of the teaching at the Madras Trade School is done by gentlemen who are employed in Engineering and other firms in Madras. The teaching is therefore thoroughly practical.

The Director hopes hereafter to extend the technical education by establishing other centres of instruction, by teaching other subjects in addition to those at present taught and by undertaking the practical teaching of more advanced and more difficult work.

INDUSTRIAL EXPERIMENTS.

Pencil factory.—The Government have set up a pencil factory to see whether pencils can be manufactured in India with profit. The result has been successful, and the factory was sold to a Syndicate headed by Mr. C. Ramanujam Chetti, which is now carrying on the manufacture of pencils. Pencils are made from a wood imported from East Africa and graphite imported from Ceylon. Suitable wood for pencils has not yet been found in Madras.

Manufacture of glue.—Experiments were made in the manufacture of glue for war purposes, and the glue produced is now being tested. Hitherto no glue had been successfully made in India.

Soap factory.—The soapworks in the West Coast were started on the advice of Sir Frederick Nicholson to prove that good soap can be profitably made and sold at a reasonable price. The soap factory will be retained by Government in order to train chemists in the soap and oil trades and to show how soap manufacture can be carried on as a village industry. It is likely that many private companies will be formed in India to manufacture soap and other articles from vegetable oils, and it is therefore important that many Indian chemists should be able to get a practical training in the chemistry of oils and soaps, so that the private companies may be able to get the services of well-trained chemists. It is likely that such companies will be ready to give employment to trained Indian chemists in the future.

It is thought also that if the villagers are taught the manufacture of soap in their houses in the village, good soap will be made in place of the impure soaps which are now sold throughout South India.

It is hoped that the soap factory which now does its work with difficulty in rented buildings will soon be greatly enlarged and improved, so that it will be possible to train those who desire to enter the industry.

The Director of Industries describes the aims of the department as follows:—

(1) To develop and make use of the resources of the Presidency to the utmost.

(2) To develop the resources of the Presidency to use Indian capital wherever possible.

(3) To train the young men of Madras to an industrial life.

(4) To help all those who seek our help in order to achieve the above-mentioned ends and to co-operate with others whose object is the same.

THE BRITISH EMPIRE SUGAR RESEARCH ASSOCIATION.

The following memorandum has been received from the British Empire Sugar Research Association, London, and is published for general information :—

The need for a British Sugar Research Association has so long been felt by sugar planters, refiners and all those manufacturing firms directly and indirectly concerned with sugar, that the formation of such an Association as has now come into being will be welcomed.

With the assistance and support of the Government Department of Industrial and Scientific Research, a strong association has now been formed, whose Memorandum and Articles of Association, and Prospectus, have received the approval of that Department, as well as that of the Board of Trade. On May 30th of this year, this Association was registered under the presidency of Sir George Beilby, who is a member of the Advisory Council of the Government Department of Industrial and Scientific Research. The Vice-Presidents are the following distinguished gentlemen:—The Rt. Hon. Lord Bledisloe of Lydney, K.B.E.; Sir Daniel Morris, K.C.M.G., D.C.L., D.Sc., LL.D.; Sir Edward Rosling; Professor E. J. Russell, O.B.E., D.Sc., F.R.S.; Professor W. Bateson, D.Sc., F.R.S.; Professor J. Bretland Farmer, D.Sc., M.A., F.R.S., and Mr. Edward Saunders.

The gentlemen elected to the Council represent *every branch of the Sugar Industry throughout the* Empire.

The aim of the Association is to establish, in co-operation with the Government Department of Scientific and Industrial Research, an Empire Scheme for the scientific investigation, either by its own officers, or by Universities, Technical Schools and other Institutions, of the problems arising in the Sugar Industry, and to encourage and improve the technical education of persons who are or may be engaged in the Industry.

The Association is inviting all those who are engaged in any Branch of the Sugar Industry within the Empire, to become members, and thus become eligible for benefits resulting from the scientific investigations it will carry out.

While it may be admitted that research work has always been proceeding in scattered localities of the Empire, where cane and beet are grown, and also in England where sugar is refined, as well as in Factories where sugar is an ingredient for the manufacture of the finished article, such research is carried out by the Factory's Chemist, who works continually for the improvement of sugar manufacture. Such improvements, however, often remain only half investigated, owing to the time given to routine work, which is the main occupation of the Factory Chemist. There are few factories who can employ a *highly skilled chemist mainly for research work*, therefore the necessity for an organized association where research will be carried out by the best brains for the general benefit of the Empire sugar industry, is felt daily more and more.

The scope of the work to be done by the Association will include the investigation of problems arising in all branches of the sugar industry, including the improvement of the sugar-cane, sugar beet, the various methods of extracting the sweetening matter from cane and beet, the various process of refining, and the best methods for the use of sugar employed by manufacturers using sugar as one of their raw materials, as well as the discovery of the best uses of the after-products of both factory and refinery.

In order to make the research work of the Association of the greatest possible utility to the industry, power has been taken, not only to encourage the training of research workers, but also to improve the technical education of persons, engaged, or likely to be engaged, in all branches of the sugar industry.

A survey is being made of the field of research which is likely to be beneficial to the Industry, and it is hoped that members of the Association will be willing to assist in the framing of a thoroughly comprehensive *scheme, by making suggestions relating* to that part of the industry, with which they are intimately acquainted.

It is also proposed to establish a bureau of information for the sugar and allied trades industries, to which any member of the Association can apply for assistance in the technical and other difficulties which he may encounter in his business.

By means of its various activities, as an Association for sugar research, a bureau of information, and a centre for the furtherance of technical education, it is hoped that the British Empire Sugar Research Association will exercise a far-reaching and beneficial influence on the future welfare of this ancient and important industry.

INDIGO INVESTIGATIONS AT PUSA.

I. Botanical.

We take the following from the Report of the Imperial Economic Botanist at Pusa for the year 1918-19:—

In the last year's report, a somewhat detailed account was given of the work in progress on Java Indigo. This dealt with a study of the conditions necessary for growth and for seed formation, of the factors of importance in root development and of the principles underlying improvement by selection. These investigations are being continued and extended. During the past year, a number of interesting results have been obtained many of which bear on the practical aspects of the industry.

INDIGO WILT.

One of the difficulties encountered in the cultivation of the Java indigo in Bihar is a condition known as wilt. After the middle of the monsoon, it often happens that the Java plant ceases to thrive, growth slows down, the foliage changes colour and afterwards becomes progressively reduced in amount. This is followed by the gradual death of the plant. Associated with the wilted condition during this *period is extensive destruction of the fine roots and* nodules. As there appeared to be a connection between the rise of the subsoil water in Bihar and the development of wilt, a series of lysimeter experiments was carried out in 1918 in order to determine whether or not there is any relation between water-logging from below and the appearance of this trouble. The lysimeters consisted of cemented tanks, $\frac{1}{100}$ of an acre in area, built above the ground level and provided with drainage openings

which could be closed or opened at will. Two series of three lysimeters were constructed. One set was filled with soil from the Kalianpur farm near Cawnpore, the other with light Pusa soil. The Kalianpur soil is exceedingly rich in available phosphate (0·318 per cent) while Pusa soil, when analysed by Dyer's method, gives very low figures for available phosphate (0·001 per cent). The results obtained were as follows :—

(1) In both Pusa and Kalianpur soil, the indigo in the lysimeters with free drainage escaped wilt.

(2) When the drainage openings were closed and water logging from below took place, all the plants were wilted in both Kalianpur and Pusa soil.

(3) The wilt in the Kalianpur soil (rich in available phosphate) was much more pronounced than in Pusa soil (said to be low in available phosphate).

(4) The growth in Kalianpur soil was much slower than in Pusa soil.

(5) The stoppage of drainage brought about an interesting change in the root system of the indigo and caused the laterals to run near the surface.

ROOT DEVELOPMENT.

The systematic examination of the root system of this crop throughout the year, in various soils and under different conditions of growth, continues to yield interesting results. This work is still in progress and is not likely to be completed for some time. The effect of previous waterlogging on stiff soil on the root system is very marked. Five months after sowing, equal areas on the waterlogged and control plots were taken and the heights of the plants were measured. On the waterlogged plot, the average height of 200 plants was 10·4 cm., on the control the average height of an equal number of plants was 28·0 cm. When the root system of the plants on these plots was examined, it was found that the first effect of waterlogging was to restrict the roots to the upper layers during the first few months of growth and to change the general character of the root system. The development of the tap root is soon arrested and later in the season one of the laterals after bending takes its place. When the sub-soil is more porous, the effect of waterlogging before sowing is less.

SELECTION.

An important discovery has been made and utilized in the selection work in progress on Java indigo. Some time ago it was observed that if any set of August sown seed plants is cut back during the early hot weather, there is a great range in the capacity of the individuals to form new growth. There is every gradation between abundant and rapid new growth and the development of weak wilted branches.

SEED PRODUCTION.

For the fifth year in succession, the continuous Java indigo plot in the Botanical Area yielded a fine crop of seed in spite of an unfavourable season due to the heavy rains in August just after sowing and to the early cessation of the monsoon in September. This plot has never received any artificial manure nevertheless the seed crop continues progressively to improve. A good crop was also obtained on a field lent by the Dholi Estate. In this case also no artificials were applied to the land and the present is the third crop of indigo seed which has been raised during the last three years.

In connection with these field results, the effect, on the growth and seed formation in this crop, of alterations in the soil texture was investigated by the modified system of pot culture described in a paper read at the Indian Science Congress at Lahore.* In this method, the soil conditions down to a depth of two feet can be altered by the addition of such aerating materials as sand, broken tiles and leaf mould or a combination of these substances. The effect on the growth and seed formation is given in the table on page 341 where the results are expressed in grammes in terms of 50 plants.

The effect of altered soil texture on growth and seed formation in Java Indigo.

Soil treatment	Weight of dry stems (excluding leaves)	Weight of dry seed
1. Control (soil disturbed) ...	68	32
2. Soil 1/2 + sand 1/2 ...	127	70
3. Soil 9/10 + potsherds 1/10 ...	118	92
4. Soil 8/10 + potsherds 2/10 ...	141	94
5. Soil 7/10 + potsherds 3/10 ...	136	89
6. Soil 4/10 + potsherds 3/10 + leafmould 3/10	744	511
7. Soil 7/10 + leafmould 3/10 ...	907	577
8. Soil 5/10 + patsherds 2/10 + leafmould 3/10	905	595
9. Soil 6/10 + potsheds 1/10 + leafmould 3/10	715	685
10. Control (soil disturbed) ...	72	32

Agricultural Journal of India, Special Indian Science Congress Number, 1918, p. 36.

An inspection of the table shows that while the substitution of ten to thirty per cent of the soil by potsherds multiplies the yield of seed three times, the effect of leafmould with or without potsherds was much greater. Thus the substitution of forty per cent of the volume of the soil by leafmould (30 per cent) and potsherds (10 per cent) increased the production of seed twenty-one times. Another interesting feature was the cessation of growth in length in all cases at the beginning of December quite independently of the soil conditions or of the size of the plants. This always occurs under field conditions. For large yields of seed, large plants must be produced by the beginning of December and practically all the seeds must have set by this time. Bearing in mind the small amount of growth which is possible up to the beginning of October, it is evident how rapid the development must be during October and November if crops of seed over ten maunds to the acre are contemplated.

THE GROWTH OF INDIGO.

A large amount of careful experimental work has been carried out on the conditions necessary for the establishment of the ordinary crop. Sowing should be done early—if possible before the *hathia* in the beginning of October—and the land should be clean fallowed and well cultivated beforehand. Later sowings are nothing like so successful. As regards the soil conditions necessary, the addition of moderate dressings of organic matter, applied in the hot whether or on the early rains, greatly assists in the establishment of the seedlings and in the early growth of the crop. If sown on very poor land, it has always been observed that Java indigo establishes with great difficulty and that numerous blank spaces occur. These results indicate the need of combined nitrogen for the early growth of this leguminous crop. This was confirmed by the behaviour of indigo on plots uniformly manured with 15 maunds of oilcake to the acre, a portion of which was waterlogged for a month before the crop was sown. It is known from previous experience of the Pusa soil that waterlogging for a month during the late monsoon is sufficient to bring about extensive losses of combined nitrogen through denitrification. On the waterlogged portion of the plot, the indigo grew with great slowness at the beginning compared with the control and this difference has always been maintained through the hot weather. Thus the field results as well as those secured by the modified system of pot culture, all point to the need of combined nitrogen in establishing a good stand of Java indigo. On the other hand, it is well known that heavy dressings of substances like *seeth*, oilcake, and farmyard manure stimulate vegetative growth at the expense of indican formation, a process which takes place best if the plant is grown on land somewhat on the poor side. An interesting field of investigation is therefore indicated. It may be found to pay to stimulate the crop a little by means of organic matter so as to establish it rapidly and strongly even if the yield of indican per 100 maunds of green plant is thereby slightly reduced. The increased produce of indigo per acre might be found to pay. Such a matter, however, cannot be settled by experiments on small plots on account of the well known difficulty in Bihar of obtaining even land to the depth made use of by this crop, and of manufacturing small lots of green plant. It is a matter which will have to be decided by general experience of work under estate conditions. Possibly the easiest and most economical method of testing the point would be to manure for the previous crop and to raise the indigo on land in fair condition.

II. Bacteriological.

The following are extracts from the Report of the Imperial Agricultural Bacteriologist (Mr. C. M. Hutchinson) for the year 1918-19:—

The isolation of considerable quantities of pure indican in the laboratory of the Indigo Research Chemist permitted the use of synthetic media for the cultivation of the various strains of indican hydrolyzing bacteria already isolated in the Bacteriological Section during two previous seasons on agar made up with indigo leaf extract. It was found that very little growth or hydrolysis took place in media in which indican was the only source of nitrogen, whereas the addition of small quantities of leaf extract activated this at once. Study of the physiological aspects of this question is being carried on.

MANUFACTURE.

Further experiments were carried out in the experimental factory on the hot water extraction method. Very good results were obtained by the use of lima precipitation following extraction and preceding inoculation with hydrolyzing bacteria; the improvement not only included higher percentage extraction of the indican present in the plant, but greater purity in the product. Experiments were initiated in the use of hypochlorite sterilization of the water and plant as an alternative to hot water extraction; this would be a very much cheaper method of eliminating undesirable bacterial flora than the use of hot water, but it is not yet clear, whether it will be possible to obtain the high percentage extration of indican given by the latter process.

A point of great practical interest arose during the first days of manufacture. It has found that

owing to the "weathering" of the cement-lining surfaces of the vats during the months intervening between one manufacturing season and the next following one, lime was set free by disintegration in sufficient quantity to produce an alkaline reaction in the steeping water of such a degree as to interfere seriously with the growth and activity of the hydrolyzing bacteria; in this way fermentation was delayed to such an extent that even after twelve hours this process then normally complete was only just beginning. It was found necessary to add considerable quantities of acid (250 c. c. of 50 per cent sulphuric acid per 600 gallons) to neutralize this alkalinity. There can be no doubt that a similar action takes place in all factories using cement-walled vats, and that the "warming up" of the vats commonly noticed at the beginning of each season is due partly to the removal of the disintegrated lime from the walls as well as to the gradual establishment of the necessary bacterical flora.

It is of interest to note here that numerous reports have been received from indigo factories of improved yields resulting from the use of cross walls or other methods of increasing the wall area of the vats, recommended (1917-18) as a result of the discovery of the importance of bacterial action in the fermentation of the indigo plant.

INDIAN STORES COMMITTEE.

The following resolution (No. B. 506-11, dated the 5th December, 1919), of the Government of India, Indian Munitions Board, on the constitution of a Committee to devise a scheme for the proposed purchase of stores in India, is published as a supplement to last week's *Gazette of India*:—

The most obvious and direct from of assistance which the Government of India can give to the industries of the country is by the purchase of supplies required for the public services so far as possible in the country itself. This principle is already clearly expressed in the existing Stores Rules, although their key note is economy, an essenial factor in any scheme for the purchase of Government stores; but indenting officers have in practice been too often deterred by the risk involved in purchasing in India in the absence of an expert purchasing and inspecting agency. It follows, therefore, that the constitution of a fully equipped stores agency in this country is a very important item in the policy of industrial improvement on which the Government of India are now embarked.

2. The foregoing principles were set forth by the Indian Industrial Commission, accepted by the Government of India and approved by the Secretary of State; they have already been put into practice to a limited extent under war conditions by the Indian Munitions Board and the time has now come to give them permanent effect. The Government of India have, therefore, with the sanction of the Secretary of State, decided on the appointment of a Committee to work out a detailed scheme.

3. There are, however, other factors which must be considered in framingany such scheme. In the first place, the Provincial Government have generally expressed a desire for some measure of freedom in arranging for their own purchases, although they recognise the assistance that the creation of an efficient central purchasing and inspecting department could afford, even to the largest and best equipped provincial Stores department. Although from the point of view of the producer Provincial Governments are not individually very important purchasers in comparison with the large consuming departments of the Government of India, yet their demands are on a sufficient scale to make the waste of public money, which inevitably attends inexpert purchase and ineffective inspection, run into considerable figures; and this is bound to lead in the long run to dissatisfaction with local sources of supply. It will be for the Committee, in consultation with the officers of Local Governments and with private suppliers, to devise a system which will, so far as possible, meet the wishes of Local Governments, while securing to the fullest extent practicable the great advantages of centralised purchase, thereby eliminating competition between the different Government agencies, and of an expert and highly specialised inspecting agency, whose advice and assistance will be of no less value to the private manufacturer than to the Government indentor.

4. The great railways of India, whether Company or Government lines, are large consumers of stores, and have, therefore, found it necessary to create their own agencies for holding stocks, and for effecting local purchases, the latter being often on a very considerable scale. There is, however, at present no agency for ascertaining whether stores bought through the Director-General of Stores could have been obtained in India; nor do the railways possess any specialised purchasing or inspecting agency for the different classes of articles which they require; but they are able to rely to some extent on the Superintendent of Local Manufactures and on the Test House at Alipore to check samples of articles locally obtained. The usefulness of the institutions

has been considerable, though limited in direction; and proposals are on foot for establishing another test house in Bombay. The Government of India, who have large financial interests in railways, desire *to have before them clear information regarding the* probable benefits which railways could expect from the assistance and advice of a fully equipped stores agency, and as to the lines on which that assistance could be most advantageously afforded. In this connection it will be desirable for the Committee to frame proposals for the future control, duties and equipment of the existing test house and for the provision of additional test houses if necesssary.

5. The method of providing military stores is a matter which will be doubtless considered by the Committee, which has been appointed to report on the administration and organization of the Army in India. This Committee will derive great assistance from the conclusions of an expert body such as that which is being appointed under this Resolution; and the Government of India consider that the most convenient procedure will be for the Indian Stores Committee to proceed with their enquiries on the assumption that the military authorities will require to be provided with stores purchased in India under much the same conditions as other departments of the Government of India; but to ascertain from time to time the views of the Committee on the Army in India, and have regard in framing their own proposals, so far as appears to them proper and feasible, to the views of that Committee.

6. The Government of India have had under consideration the question of the purchase of food and fodder for the army. It has, however, been decided not to include this question within the scope of the present enquiry.

7. The Government of India have decided to constitute a Committee to enquiry into the matters indicated in this Resolution, and to frame a definite and so far as possible a detailed scheme for the purchase and inspection of stores in India. Certain general principles have been, it will be observed, accepted by the Government of India and the Secretary of State. It will not be necessary for the Committee to discuss these further; and they should concentrate their attention on the difficult and complicated task of devising a scheme which will as far as possible meet the needs of the different interests concerned, while keeping fully in view the fundamental principles of efficiency and economy.

8. The Committee will consist of the following gentlemen:—

President:

1. Mr. F. D. Couchman, M.I.C.E., Member, Railway Board.

Members;

2. Mr. G. H. Collier, C.I.E., Director-General of Stores, India Office, London.
3. Mr. F. Palmer, C.I.E., M.I.C.E., M.A.S.C.E., F.R.G.S., late Chief Engineer, Port of London Authority,
4. Colonel H. A. K. Jennings, C.I.E., Inspector of Quarter-master General's Services.
5. Lieutenant-Colonel C.C.H. Hogg, C.M.G., R.E., Superintending Engineer and Secretary to the Hon'ble the Agent to the Governer-General in Rajaputana in the Public Works Department.
6. Mr. H. N. Heseltine, C.I.E., Accountant-General, Railways *(Retired)*.
7. Mr. A. W. Dods, of Messrs. Burn & Co., Calcutta.
8. Rai Bahadur Lala Milki Ram, Chief Storekeeper, Oudh and Rohilkhand Railway *(retired.)*
9. Mr. Lalji Naranji, of Messrs. Lalji Naranji & Co., Managing Agents, the Jupiter General Insurance Co., Ltd., Bombay.

Mr. J. C. Highet, Assistant Secretary, Railway Board, has been appointed Secretary to the Committee.

9. The terms of reference are as follows:—

In view of the necessity of encouraging Indian industries, while at the same time securing economy and efficiency in the purchase of Government requirements, the Committee should enquire and report:—

(a) What measures are required to enable the Departments of the Government of India and of Local Governments to obtain their requirements as far as possible in India, and what central and local agencies for purchase and inspection should be constituted;

(b) What should be the relations of such agencies with one another and with the Stores Department of the India Office, or such other purchasing organization in England as may hereafter take the place of that Department;

(c) What modifications of the Stores Rules will the scheme recommended by the Committee necessitate.

EDUCATION IN AMERICA.

Scholarships.

Frances Adney writes to the *Commonweal* :—

Nearly all the better-equipped private educational institutions in America possess special funds for assisting needy and deserving students. Some of our State institutions also give this type of aid. A "scholarship" is an annual stipend, generally large enough to cover the tuition fee, often somewhat larger, which is granted to a student of good ability and character upon the representation of his needs.

Some scholarships are awarded as prizes for high scholastic standing, without reference to the student's financial status. Some again are bestowed only upon those students who have demonstrated marked capacity, and are also known to need pecuniary assistance.

Some institutions have loan funds, from which a student may borrow, if he can give good security.

Large stipends, called "fellowships" (viz., ranging from $ 150 to $ 600 per year), have been established at many Universities for the benefit of graduates and professional students of unusual ability and promise. Certain of these fellowships for students in graduate schools carry the obligation of teaching from one to six hours a week in under-graduate classes. A few Universities maintain travelling fellowships some of which pay as much as $ 1500 per annum. These are generally awarded to advanced students whose researches might be especially furthered by visiting some foreign country.

The foreign student is advised to apply for the catalogue of any College or University to which he may feel attracted. A catalogue or circular of information is sent free on request, and generally contains full information concerning scholarships, followships. teaching staff and equipment.

It would be prudent for any Indian seeking education here to have funds to cover his first year's expenses, unless he has friends who can assist him to find work. There are many opportunities here for making one's own way through college; almost countless ways of earning a living; yet, in a new country, amid strange customs, an Indian might find himself seriously handicapped during the first year of his residence.

The foreign student contemplating a three or four year period of University study in the United States should understand that there is each year a long vacation, American schools and colleges being in session on an average of about eight months in the year. The University year generally begins about the middle of September and closes about June 15th. (Californian schools vary widely as to the time of vacations, owing to climate differing essentially from other sections of the country; but the aggregate length of vacation time is about the same through the States.) At some institutions the University year is divided into two semestres, the division line coming about the 1st of February; other colleges divide the year into three semestres. Approximately a month is devoted to short vacations of from one to fourteen days' duration scattered throughout the academic year. The prices quoted by different colleges for dormitory room-rent is generally for the academic year of nine months, Occupancy of the rooms during the short vacations is included. Students are usually not allowed to occupy dormitory rooms during the long summer vacation.

This long summer vacation gives the poor man or woman an opportunity to earn money. For the student who can afford it, it is exceedingly desirable that he should spend at least a part of the summer in travel. The United States contains many racial stocks, many of them concentrated in limited areas; and its industries, climate and conditions of living are so varied that no single community can be regarded as typical.

Realizing the need of detailed information for foreign students as to American school systems, the U. S. Secretary of the Interior, Washington, D. C., directed Dr. Samuel Paul Capen, specialist in higher education in the Bureau of Education, to prepare a document for publication which should cover this field. This educational guide is the source of much of the following information.

The American educational system cannot be treated as a unit, for it comprises many varieties of organizations in forty-eight independent States. There is a network of colleges, universities, academies or fitting schools, high and elementary schools covering the entire land. Parts of this system are as follows:

Elementary schools within the reach of every home.

High schools, or secondary schools, in every considerable town.

Land grant colleges, with special reference to the agricultural and mechanical arts in all the States.

State Universities in practically all States except a few eastern States.

Normal schools, or training schools for teachers, in every State.

Free schools for defectives in all the States.

National academies for training officers for the army and navy.

In addition to the above outlined public education-al system, there are many [illegible]

of private foundation, such as kindergartens, music *and art schools, industrial and professional schools*, denominational colleges and universities, and universities and colleges supported chiefly by private endowment.

The American college seems to have no exact counterpart in the educational system of any other country. It occupies the place of central importance *in the outworking of higher education here, being* the repository and shelter of liberal education, as distinguished from technical or commercial training. Traditionally, *its curriculum covers a period of four* years, and grants baccalaureate degrees. There are usually three kinds of under-garduate degrees, Bachelor of Arts, which usually requires the two classical languages of Latin and Greek; second, Bachelor of Science, which, before the War, required the two modern languages of French and German, and *the third*, Bachelor of Philosophy, requiring Latin and one of the modern languages.

Even before the War, when standards were not in their present fluidic State, the most significant feature of American Universities and colleges, was their lack of standardisation. The two are often confused, although according to the recognized definition, "a *college is a simple institution with at least six* professors giving their entire time to college and university work, a course of four years in liberal arts and sciences, and requiring for admission not less than four years of high school preparation, in addition to grammar school studies.' The University, on the other hand, is a complex institution which includes, in addition to the college proper, several specialised departments and professional schools, such as colleges of engineering, agriculture, medicine, veterenary medicine, dentistry, law, commerce, journalism, pharmacy, education and theology. At the top of all is the Graduate School of Arts and Sciences, which grants the degree of Ph. D. on the completion of at least three years' work in some special field of research.

The following departments are usually established by an *American University: Philosophy, Psychology* Education, Political Economy, Political Science, History, History of Art, Sociology and Anthropology, Household Administration, Comparative Religion, Oriental Languages and Literatures, New Testament, Old Testament, Comparative Philology, Greek, Latin, Romance Languages, English, German, General Literature, Mathematics, Astronomy and Astrophysics, Physics, Chemistry, Geology, Geography, Zoology, Anatomy, Physiology, Botany, Pathology, *Hygiene*, *Bacteriology*, Public Speaking and Physical Culture.

Admission to practically all institutions of higher education is based on the completion of a four-year course in a secondary school, which, expressed in *the terms of "unit" is equivalent to sixteen units.* A unit represents a year's study in any subject, constituting approximately a quarter of a full year's work.

This statement is designed to afford a standard of measurement for the work done in secondary schools. It takes the four year high-school course as the basis, and assumes that the length of the school year is from 36 to 40 weeks; that a period is from 40 to 60 minutes in length; and that the study is pursued *for four or five periods a week; but under ordinary* circumstances, a satisfactory year's work in any subject cannot be accomplished in less than one hundred and twenty 60-minute hours or their equivalent. Schools organized on any other than a four year basis can, nevertheless, estimate their work in terms of this unit.

Two methods of admission are common. Throughout the West and Middle West, and, to a certain extent the east also, Colleges and Universities admit *by certificate. Under this plan, a candidate for* entrance must present a statement from the principal or head-master of the school which he has attended, showing the amount and character of the work he has done. If the certificate indicates that the studies required for entrance have been satisfactorily pursued, and if the standing of the school issuing the certificate is known and approved by the college authorities, the student is admitted without further formalities.

The other method of admission, in vogue in a number of the older institutions of the Eastern States, is by examination. In order to systematise both the entrance examinations, and the courses offered by secondary schools in preparation for them, some 30 institutions which admit by this method, together with the principal associations of colleges and secondary schools, have formed an organization to conduct examinations, known as the College Entrance Examination Board. A student is admitted *to any college which is a member of the Board* if he passes the examinatidns set by the Board in the subjects required by the college for entrance. The standards maintained by the Board are so high that a certificate showing that a candidate has passed its examination is generally accepted for entrance by all American institutions for higher education, although a few insist upon conducting their own examinations.

This College Entrance Board holds examinations in almost every State of the U. S., and, as late as 1916 (and probably at the present time) in Honolulu, Oahu College, and at University College, Gower Street, W. C., London, England. A document

showing places of examination will be sent on receipt of 10 cents by the Secretary, Post Office Sub-station 84, New York City.

Detailed information of various College and University requirements may be obtained by request from The Bureau of Education, Washigton, D. C., U. S. A. The two tables herewith appended, however, should enable the student to determine in some measure his probable ability to enter a standard College or University. The tables should be used together, the first indicating the range of subjects required or accepted; the second the scale of values in terms of units endorsed by the College Entrance Examination Board. Most institutions are willing to make some concessions from the strict letter of the requirement to students from foreign countries who can demonstrate an equivalent preparation in subjects other than those prescribed.

Some years before the War, a Swiss girl determined to get an education in America. There was no co-education in her country. While her brothers were sent to college, she studied and worked at anything practicable in order to earn sufficient money to bring her here. Her parents would not consent to her plan, and she was obliged to wait until she was twenty-one before she could leave Switzerland. The catalogue of Leland-Standford University at Palo Alto, California, had fallen by apparent chance into her hands; but the requirements were not clear to her mind. However, she was strongly attracted to the place. She wrote to the Registrar stating her acquirements which were mostly linguistic and literary. The Registrar took a kindly interest in her and advised her to come and make up the requisite entrance studies after her arrival. This heroic little Swiss woman set forth, without a friend or acquaintance in America; and, after reaching Now York, she was by mischance routed over the southern railway system, which took her many miles out of her course, and so exhausted her little money-store that she arrived in San Francisco with exactly $2-50 in her purse. That amount was sufficient to take her to the college, where the Registrar took her into his home for a time. She not only earned her college expenses, and made up the requirements but she did a four years' course in three years, and gained in addition a scholarship which enabled her to do Post-graduate work in the University of California. She is a splendid example of pluck and brilliant mental endowment combined: and, to make the tale complete, she married a Hindu and is living happily in the Howaiian Islands.

BOOKS IN BRIEF.

Economic Problems of Peace After War.—*First and second series. By W. R. Scott, M.A., D. Phil., Litt. D., L.L.D. Adam Smith, Professor of Political Economy in the University of Glasgow. Published by the Cambridge University Press. Price 1st Series 4sh. 6d. net and 2nd Series, 6sh. net.*

These volumes by Dr. Scott deserve high praise, not only for the knowledge they bring to bear on the great problems of peace after war but also for the lucidity with which they deal with them. The first series forms a sort of introduction for the second, though in itself it is full of suggestive thought. There is so much in it that is dealt with in the true spirit of the scholar that we should be sorry to detail here its contents. To take only one subject dealt with by Dr. Scott: The future arrangement of industry. What should it be? He discusses the point how far the influence of evolutionary theory may have disguised the facts. Industry, in his opinion, should be considered here as an evolutionary process than as a problem, namely the attaining of a harmonious relation between the human agents concerned in each individual act of Production. He thinks that the larger part of the practical steps in the future will be the recognition of the problem as to the need for a less imperfect co-operation of the various factors of Production. In the second series, Dr. Scott discusses many interesting topics, one of the chief of which is that of the financial burden created by the war and how to deal with it. Conscription or Prescription? The historical knowledge that is brought to bear on this subject should render impossible a hasty decision in the matter. He also discusses in one interesting chapter as to what should guide us during the period of financial transition. Both the series form in our opinion, a real contribution to the subject of War Finance and as such ought to attract wide attention.

The Making of Modern England.—*By Gilbert Slater, M. A. D.Sc. Published by Messrs. Constable & Co. Ltd. London. Price 7sh. 6d.*

We have read this book with great interest from cover to cover. The story of the making of England is told with skill by Dr. Slater, the space devoted to political, Economic and social factors being illustrative of the great sense of proportion he has displayed in handling the highly difficult task he set himself. We think he has made good in his treatment of the subject the ideal he wishes critics and writers should bear in mind in the discussion of geonunde topics. "The claim I make," he says in the preface to his book,

"is that the raising of party conflict round any question of economics or politics must not be allowed to exclude the question from the field of scientific research, but that on the other hand, the fiercer the conflict, the more necessary it is for the ordinary citizen to endeavour to bring to his judgment of the issue the same freedom from bias and loyalty to truth with which the historian studies the bases of the social order of Athens, or the wars of the Egyptian King. India comes in ones or twice for attention in the book and we think Dr. Slater has something useful to say on each occasion.

"The first and greatest of all the problems of Empire is the problem of India" says Dr. Slater. He then goes on:—

"Among the prominent facts with regard to India which are confessed in the Statistical Abstract, are that the average death-rate for the ten years ending 1908 was between thirty-four and thirty-five per thousand, which represents an excess of unnecessary deaths, judging by the standard of a country like Japan, of some four millions per annum. Poverty and ignorance are the obvious causes of this appaling death-rate. The fundamental duty of the Government is to protect the people against devastating plagues and famines; and the obvious means of doing so is to train the most gifted of the native population to lead the people in the fight against the evils which beset them. How little the British Government in India realises this duty may be judged by the statistics of graduates turned out in the year 1909-10 in different professions; in medicine there were but thirty, in engineering only seventeen; in Agriculture not a single one: but in arts there were 2,116, and in law 576."

His complaint is not against the Indian Civil Service but against the system. He formulates his grounds thus:—

(1) "That the English Civil Servants in India re too few and too much absorbed in the duty of maintaining the Government as it is and in dealing with difficulties like plague and famine, to have leisure and energy to tackle the great problem of lifting up the whole standard of the material well-being of the natives.

(2) That the ghost of the economic doctrine of *laissès faire*, and other obsolete ideas which allow only a very restricted scope to the energies of the Government, still cling round our actual practice, so that it is scarcely regarded by parliament or by the Office of the Secretary of State as an urgent matter that the Government should seriously set itself to work to minimise Indian poverty.

(3) That the method of training of our higher Civil Servants is entirely inadequate and unsuitable. Education in the public schools and at Oxford is about the worst possible preparation for training a man to see how to utilise every development of mechanical and biological science, medicine and hygiene, for the benefit of an Asiatic people."

If Dr. Slater writes frankly it is with a view to have matters remedied. It is to be hoped that under the new form of Government sanctioned by the Indian Reform Act adequate remedial measures will be adopted.

British Budgets, 1887-1913—*By Bernard Malet, C.B. Published by Messrs. Macmillan & Co. London. Price 12sh. net.*

This is a facinating book and deserves the very highest praise. The story of each British Budget during the years 1887-1913 is unfolded by Mr. Malet in a manner at once impressive and taking. Nothing can be more difficult than that even for the most skilled writer in dealing with figures and facts such as a Budget usually deals with. Mr. Malet manages to present each Budget—its salient features, its departures, its new points and the criticism it evoked in either House of Parliament—in an amount of space which must, relatively speaking, be described as brief. He manages to say much in the limited range he sets himself to. His own criticism wherever it is offered' is both brief and suggestive. Whether its Gorchen or Harcourt, or Asquith or Lloyd George that he is dealing with, he is eminently fair and just both in his presentment and estimate. We would suggest a close and intimate study of this book by those interested in finance matters generally in this country. There is a great need here for clear thinking in financial matters and it is books of this kind that are likely to help towards an accurate knowledge of the intricate and often unintelligible points that go to make up a nation's budget. We commend the book to the attention of all interested in finance in India students and laymen alike. The book lacks an Index and we shall be glad to see it supplied when a new edition of the same is issued.

Money.—*By Edwin Cannan, M.A., L.L.D. Professor of Political Economy in the University of London. Published by Messrs. P. S. King and Sons, Ltd. 1 and 4 Great Smith Street, Westminister.*

Dr. Cannan is so well known in India for his works on Economics that we are sure his present book on *Money* will be welcomed by a large circle of readers in this country. In this little book Dr. Cannan furnishes a scientific explanation of the connection o money with rising and falling prices. He shows that

economic laws are inexorable in their effect and that if those who are responsible for adding inordinately to the paper currency of the country do not take heed in time there is likely to be trouble. Dr. Cannan is no alarmist: he is a sober, scientific thinker. His analysis of the existing currency position is in our opinion, both sound and just. He thus states his conclusion. "The conclusion of whole inquiry is that the value of money, which is the same thing as the general level of prices regarded inversely, is an anamolous or even very peculiar thing, but depends in the same way as the value of other commodities upon the various influences which affect demand and supply: and that if peoples dislike the rise of prices which is another name for a fall in the value of money they should insist on adequate limitation of the supply of money. This is a conclusion which has long been familar to economists; it is time it was granted by the men who pride themselves on being practical."

The Safety of the Nation.—*By Ian D. Colvin. Published by Mr. John Murray, London. Price 6sh. net.*

There is so much that is fresh in the view point of Mr. Colvin that there was hardly any need for him to fall from the classical school of Economic thought either for their errors of omission or commission or for the purpose of obtaining currency for his own views. Mr. Colvin's main point is that security before opulence should be applied to every trade and industry. Adam Smith long ago remarked justifying the Navigation Laws, "Defence is more important than opulence," Mr. Colvin seems to admit as much at p. 15 of his book. Mr. Colvin, however, thinks that he treated his observation "as an exception, not as a ruling principle." We are not so sure of that. What Huskisson and others did in the nineteenth century, to which Mr. Colvin refers in Chapter III of his book, was in our opinion, to undo the evil effects of the Navigation Laws. Huskisson declared that security was of the first importance and that commerce should give way to Navigation in case of conflict, which is a view quite in keeping with Adam Smith's great diction. Mr. Colvin thinks that Huskisson paid lip worship to our ancient National policy of security. Few dispassionate writers will agree with this verdict. This apart, Mr. Colvin is all for a national party that would make security of each industry its cardinal article of faith. In this view the British Empire producers' organization receives his praise. He writes:.." A national party founded upon industry would have a national inspiration, a national ideal. They would insist that the points of British industry went to the British people; they would oppose the free importation of foreign subjects as much as the free importation of foreign wares; they would recognise British nationality as a birth right which was no longer to be sold for a licensing fee, and they would admit aliens only to teach us those arts and crafts of which our people were ignorant." Mr. Colvin deserves praise for the courage with which he puts forth his convictions.

Coal Nationalisation.—*By Edvin Cannan, M.A., LL.D. Published by P. S. King & Son, Ltd. London. Price 2sh. net.*

This is a precis of the evidence offered by Professor Cannan to the Coal Industry Commission. From the prefatory note annexed to the booklet, we note that Professor Cannan publishes it because the whole of his evidence including his written precis has not been given publication to in the official Report of the Commission. This is as it should be as a great many like Professor Cannan do not like to go down to posterity even in a blue-book, in the form of "selections." Professor Cannan is not entirely destructive in his views; he is, as may be naturally expected ,of distinguished scholar like him, as well constructive. Though opposed to nationalization, he is for greater publicity of mine profits and for the creation of a miner's dividend. This drew forth in cross examination that he favoured Syndicalism but Professor Cannan said he was not at all afraid of it if it was considered as something which may be led up to by a gradual processes." The booklet merits careful attention for the question of nationalisation of coal mines is one of the burning questions of the day.

ACKNOWLEDGMENTS.

Report on the Working of Co-operative Societies in Bihar and Orissa for the year, 1918-19. *Patna. 1919. Price—Indian, Re. 1; English, 2s.*

Report on the Administration of the Department of Agriculture of the United Provinces of Agra and Oudh, *for the year ending 30th June, 1919. Allahabad. 1919. Price, annas eight, 1s.*

The Saving of Irrigation Water in Wheat Growing. *Second Edition. By Albert Howard, C. I. E., M. A., Imperial Economic Botanist, and Gabrielle L. C. Howard, M. A., Second Imperial Economic Botanist., Calcutta. 1919. Price 6 Annas.*

Report on the Administration of Mysore for the year 1918-19.—*Bangalore. Printed at the Government Press. 1919. Price one rupee.*